ORIGINAL ARTICLES.

INTESTINAL PERFORATION DURING TYPHOID FEVER IN CHILDREN.

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THE modern conception of the symptomatology, diagnosis, and treatment of typhoid perforation in general would seem to be firmly based upon the mass of carefully studied material which is now available. Aside, however, from text-book articles, limited series of personal observations, and scattered case reports, there was but little systematic work done on the subject of typhoid perforation in children with respect to treatment by operation, until the appearance of the paper by C. A. Elsberg[1] in 1903. This paper was based upon a study of 25 cases of perforation operated upon in children, all that were available at that time. While the number of cases was small, the deductions which Elsberg was able to draw were of great interest and importance. It has seemed to us worth while to study the cases occurring in children, and reported since 1903, with a view to confirming, if possible, the rather remarkable findings of Elsberg; and, at the same time, to consider briefly those points in

[1] Annals of Surgery, 1903, xxxviii.

the clinical course of typhoid fever in children that have a bearing on the diagnosis of perforation and to compare these with the symptoms commonly observed in adults.

FREQUENCY.   Perforation in children is usually considered to be relatively infrequent.   That this is true of infants and very young children is undeniable.   Typhoid fever in young children is not often attended by the grave intestinal lesions which are found in older children and adults.   Ulcerations of the bowels are few in number and superficial in character, and we find what is commonly spoken of as the "nervous type" of the disease rather than the abdominal type, which becomes the rule as we approach the age of puberty.   Hemorrhage and perforation in the earliest years of life are, therefore, very infrequently encountered.   It is not until after the age of four or five years that the intestinal lesions become of a character to favor perforation of the bowel, but from this time on the accident becomes of correspondingly greater frequency.   We have collected from various sources 2274 cases of typhoid fever in children in which perforation occurred 35 times (1.54 per cent.).

In some of the series studied, notably that of Berg,[2] 154 cases with 4 perforations, or 2.6 per cent., the percentage was higher.   Morse[3] collected 284 cases with no perforations.   Griffith and Ostheimer,[4] in 302 cases under two and one-half years, found 2 perforations (0.66 per cent.).   Two cases mentioned by Griffith and Ostheimer, which occurred at the ages of twenty and twenty-one months, respectively, are the youngest authentic examples of which we have knowledge.

We find that the percentages of perforation in typhoid fever at all ages vary from 1.5 (Skutesky) to 3.03 (Murchison) and 3.66 (Armstrong).   Harte and Ashhurst,[5] in an analysis of 8881 cases, estimate the frequency of perforation at 2.54 per cent.   We have collected 4947 cases, with a percentage of perforation of 2.19.

The relative frequency of typhoid perforation in children and adults is somewhat difficult to estimate, as the figures just quoted include cases of all ages; but it may be safely said that while perforation occurs less frequently in children, the disparity is less than is commonly supposed, the complication being probably slightly more than half as frequent in the junior class.

AGE.   In collecting cases of perforation in children for study we have fixed the usual age limit of fifteen years; we have analyzed only cases in which operation was performed and perforation proved; we have not considered cases of peritonitis occurring without perforation, nor have we studied cases of perforation of the appendix in which this lesion was manifestly due to a preëxisting or coincident

[2] Deutsch. Archiv f. klin. Med., 1895, vol. liv.
[3] Boston Med. and Surg. Jour., February 20, 1896.
[4] AMER. JOUR. MED. SCI., November, 1902.   [5] Annals of Surgery, 1904, xxxix.

appendicitis not due to typhoid ulceration. Reported since the publication of Elsberg's paper in 1903, we have found 45 cases in subjects fifteen years of age and younger, the exact age being given in 44. These are as follows:

CASE I.—Staunton. Med. Press and Circular, 1903, 609.
CASE II.—Cotton. Boston Med. and Surg. Jour., 1906, clv, 151.
CASES III.—Russell. Montreal Med. Jour., 1903, 584.
CASES IV and V. Hays. Jour. Amer. Med. Assoc., 1905, 1267.
CASE VI.—Anderson. Intercolonial Med. Jour., 1904, 64.
CASE VII.—Boyd and Moore. Ibid., 72.
CASE VIII.—Waring. Trans. Clin. Soc., London, xxxvi, 110.
CASE IX.—Bowlby. Ibid., 124.
CASES X and XI. Griffith. AMER. JOUR. MED. SCI., 1905, cxxx.
CASE XII.—Meakins. Montreal Med. Jour., 1905, 741.
CASE XIII.—Harte. Annals of Surgery, 1903, 63.
CASES XIV and XV.—Greaves. Brit. Med. Jour., 1906, i, 373.
CASES XVI.—Daniell. Lancet, 1908, i, 1043.
CASES XVII and XVIII.—Butler. Jour. Amer. Med. Assoc., November 11, 1905, 1468.
CASE XIX.—Vickery and Cobb. Boston Med. and Surg. Jour., February 7, 1907, 177.
CASES XX and XXI.—Manges. Jour. Amer. Med. Assoc., April 1, 1905, 1023.
CASES XXII, XXIII, and XXIV.—Scott. Univ. Penna. Med. Bull., May and June, 1905.
Cases XXV.—Bichat Rev méd. de l'est., 1904, xxxvi, 431.
CASES XXVI.—Scott. Univ. Penna. Med. Bull., May and June, 1905.
CASE XXVII.—Stewart. AMER. JOUR. MED. SCI., May, 1904.
CASES XXVIII and XXIX.—Scott. Ibid.
CASE XXX.—Stewart. Ibid.
CASE XXXI.—Maclean. Canada Lancet, 1904, xxxvii, 1011.
CASE XXXII.—Griffith. Unpublished, Univ. Hosp. Histories.
CASE XXXIII.—Jopson. Archiv. Pediat., March, 1904.
CASE XXIV.—Kaehler. Deut. med. Woch., 1907, No. 34, 1370.
CASE XXXV.—Turner. Australasian Med. Gaz., 1904, No. 28, 334.
CASES XXXVI and XXXVII. Griffith and Hutchinson. Unpublished, Children's Hospital Histories.
CASE XXXVIII.—Morestin. Rev. de chirugie, April, 1908, 569.
CASE XXXIX.—Rath. Harte and Ashhurst's tables, St. Timothy's Hospital Histories
CASES XL.—Glazebrook. Virginia Med. Semimonthly, 498.
CASE XLI.—Newell. California State Med Jour., 1908, vi, 103.
CASE XLII.—Jopson and Gittings (unpublished). Presbyterian Hospital Histories.
CASE XLIII.—Mauclaire. Bull. et mém. de la soc. de chirurgie, 1908, xxxiv, 449.
CASES XLIV and XLV.—Hays. Penna. State Med. Jour., January, 1908.

The youngest were aged five years, of which there were four; two recovered, and two died. There were three patients aged fifteen years, all of whom died. The numbers and ages were as follows:

	Years.			Years.
4 cases at	5	2 cases at		11
4 cases at	6	4 cases at		12
2 cases at	7	3 cases at		13
7 cases at	8	5 cases at		14
4 cases at	9	3 cases at		15
6 cases at	10			

Of 21 cases under ten years of age, 12 recovered and 9 died, a mortality of 43 per cent.; of 23 cases ten years of age or over, 10 recovered and 13 died, a mortality of 56.5 per cent.

This shows apparently a less mortality in young children, which is further corroborated by an analysis of Elsberg's table. In his

series, of cases under ten years of age, the mortality was 20 per cent.; in cases ten years of age and over, the mortality was 46.6 per cent. As we approach the age of fifteen, the mortality approximates that of adult life.

SEX. The sex was given in 43 of our 45 cases: 28 were males and 15 were females, a disparity much less than that observed by Elsberg, of whose cases, 18 were males and 6 females.

Of 3071 cases of typhoid fever in children that we have collected from various sources, 1659 were males and 1412 were females, a proportion of 1.17 males to 1 female.

Of 7848 cases of typhoid fever at all ages gathered from the statistics of Murchison, Curschmann, and others, 4452 were males and 3396 were females, a proportion to 1.31 males to 1 female. Except for Elsberg's and our own figures, we have found none which give the proportion of male to female in regard to the occurrence of perforation in children. Combining our figures with Elsberg's, there are 36 males and 21 females, a proportion of 1.7 males to 1 female.

In adults the preponderance of males over females who have been operated on for perforation is admittedly large. Harte and Ashurst give the proportions as about 4 to 1; Finney,[6] 3 to 1; and Scott,[7] men and boys, 77; women, 7 (11 to 1). Curschmann[8] considers that this disproportion in adults is not due to any inequality in the development of typhoid ulceration, but probably to the fact that in men convalescence is unfavorably influenced by previous derangements of digestion due to diet and mode of life; that they submit to treatment at a later stage of the disease than women; that they are more impatient and more careless during convalescence. In view of the almost equal proportion of sexes attacked by the disease, the disparity in the number of adult males to females who suffer from perforation might be satisfactorily explained on these grounds, as we find in children, in whom such etiological factors are absent, that the disparity in the sexes is greatly lessened.

TYPE OF THE DISEASE. In 31 cases of our series, the type of the disease previous to perforation was mentioned. Eight were mild, fifteen were moderate, and eight were very severe; of the mild cases, five recovered and three died; of the cases of moderate severity, eight recovered and seven died; of the very severe cases, two recovered and six died. The influence of the severity of the attack upon the prognosis in cases of perforation as shown by these figures seems to be considerable. The child who is toxic and exhausted by prolonged hyperpyrexia is in poor condition to resist the additional complication and operative intervention.

That children, as a rule, suffer from a milder type of the disease

[6] Johns Hopkins Hosp. Rep., vol. viii.
[7] New York Med. Jour., 1907, lxxxv; Univ. Penna. Med. Bull., May and June, 1905.
[8] Nothnagel's Encyclopedia, American edition.

than adults is generally admitted; and it is probable that this, in part, explains their lower mortality after perforation. To this rule, of course, there are well recognized exceptions. The age is an important factor. Children under three years of age and over ten years, show a much higher comparative mortality, in the former exceeding, and in the latter approaching, that found in adult life. The influence of the severity of the disease upon the occurrence of perforation, however, has not been universally agreed upon. In adults, the majority of recent writers admit that the severe cases are most prone to the accident of perforation. The most noteworthy exceptions exist in the ambulatory cases, in which the occurrence of perforation is comparatively frequent. Of 68 cases of perforation reported by Finney, 39 were ambulatory, 10 moderately severe, and 19 severe. Only 8 of the 31 cases of our own series, in which the type of the disease was mentioned, were severe.

TIME OF PERFORATION. In 44 cases the time of perforation was definitely stated. In the second week there were 11 perforations, the earliest on the ninth day; 6 occurred at the end of the second week (thirteenth or fourteenth day); in the third week there were 12; in the fourth week there were 6; in the fifth week, 3 (one relapse); in the sixth week, 4 (three relapses); in the seventh week, 3 (all relapses); in the eighth week, 1 (a relapse); and in the ninth week, 1 (a relapse). One occurred one month after convalescence. Among the cases that perforated in the second week there were 6 recoveries and 5 deaths; in those perforating in the third week there were 3 recoveries and 9 deaths; in the fourth week, 2 recoveries and 4 deaths; in the fifth week, 1 recovery and 2 deaths; in the sixth week, 3 recoveries and 1 death; in the seventh, 1 recovery and 2 deaths. The cases perforating in the eighth and ninth week and one month after convalescence all recovered. If these figures prove anything, it is that the severity of the disease, rather than its protracted course, contributes toward its mortality. The danger of perforation is greatest at the end of the second and during the third week—42.8 per cent. of all cases occurring during this period. This proportion corresponds rather closely with that of Elsberg (10 out of 24 in the third week). In adults also perforation occurs most frequently during the second and third weeks.

RELAPSES. Of our cases, 9 were in relapse at the time of perforation; in another, a probable relapse, the duration of the disease was not stated, thus making 10 cases in all. The date of the perforation ranged from the seventh to the fifteenth day of the relapse. Of these cases, 6 recovered and 4 died, a percentage of recoveries higher than that observed in unrelapsed cases. This, again, seems to confirm the conclusions mentioned above in regard to mortality being influenced by the severity rather than by the duration of the disease.

Harte and Ashhurst found a mortality in 15 cases of relapse of 46.6 per cent.; and in the convalescent cases, 36.6 per cent.—which is

much lower than at any stage except in the first week (33.3 per cent.).
Their highest mortality was observed in cases perforating in the
third week (78.1 per cent.).

PAIN. The importance of pain as a symptom of perforation is
shown by its occurrence in practically every case of our series of
which details were given. In only eight cases, taken from tables,
or discussions, in which scanty data were furnished, was it not
mentioned; and in one of these the child was under the influence of
morphine. It may be considered in its relation to the time of develop-
ment, its severity, location, and persistence.

In 87.5 per cent. (21 out of 24 cases) it was an initial symptom; in
one case it was mentioned as not being initial; in two other cases it
had been present during the illness to such an extent as to constitute
a difficulty in diagnosis. In 89 per cent. (25 out of 28) the pain was
severe. In the remaining 11 per cent. it was stated to be not severe.
In 58.6 per cent. (17 out of 29) the pain was general in distribution.
In 24.1 per cent. (7 out of 29) it was confined to the right side of the
abdomen, especially the right iliac region. In 10 per cent. (3 out
of 29) it was noted in the left side. In one case it was noted in the
"upper," and once in the "lower," abdomen. In 10 out of 17 cases
the pain was persistent, in four of which it continued to increase in
severity. In 3 out of 17 it was intermittent in type; and in 4
it was distinctly stated to be "not persistent." In practically all of
Elsberg's cases pain was the initial abdominal symptom. It was
usually localized to the lower abdomen, especially the right side,
and was generally paroxysmal; in a few cases it was constant.

Pain is thus seen to be a very characteristic and important
symptom. In the great majority of cases it is an initial symptom
and of marked severity. It is more often generalized than local,
although it favors the right side in a considerable percentage of cases,
and it is usually persistent, often increasing as time advances.

In Scott's statistics, pain at the time of perforation was observed
in 75 per cent. of the cases. Other authors state that it is usually
present, but may be entirely absent, although practically all agree
in placing it with tenderness and rigidity as one of the three cardinal
symptoms.

Except in a phlegmatic, delirious, or semicomatose patient,
whether child or adult, the occurrence of pain seems to be almost
a *sine qua non*, either of the perforation itself or of the beginning
of the localized peritonitis. In such cases it would precede the
rigidity, and possibly even the tenderness; and it might even appear to
be for a time, at least, an isolated symptom. It would seem to be
of great importance to determine the frequency with which sharp
pain, not connected with perforation, occurs during typhoid fever.

In the case of children, Adams[9] found it to be an "infrequent"

symptom throughout the course of the uncomplicated disease. Edwards[10] found it in 10 per cent. of his cases under ten years of age; and in 40 per cent. between ten and fifteen years. Butler[11] found it in 22.4 per cent. Hand and Gittings[12] record pain or tenderness in 37 per cent. Barthez and Sanne[14] "believe that pain in children is commonly seen in connection with diarrhœa, but is usually a transient symptom." Biedert and Fischl[14] also believe that pain and meteorism are neither frequent nor severe in children. In the well-known statistics of McCrea[15] pain was found in about one third of 500 adult cases at some time during the course of typhoid fever. It was most constantly present with perforation and was closely simulated in cases of hemorrhage, phlebitis, and in some cases of unknown origin. In two-fifths of all the cases of pain, no adequate cause for it was found, and in 14 per cent. the pain was due to some condition other than the intestinal lesions. Shattuck, Warren, and Cobb[16] found a record of pain in only 5 out of 70 cases without perforation or peritonitis.

While the figures of various observers both of cases in childhood and adult life vary from 7 per cent. to 37 per cent. it is, nevertheless, apparent that a real difficulty in interpreting the symptom of pain will often exist. That its occurrence can never be safely disregarded is equally obvious. The various conditions which, by giving rise to pain, may simulate perforation will be considered under the heading of diagnosis.

TENDERNESS. Tenderness was noted as being present in 36 out of 45 of our cases. Its absence in the others may depend largely on insufficient data. It was recorded as "general" in 15 cases; prominent in the right iliac fossa in 9; confined to the "lower abdomen" in 2; and once to the hypogastrium.

A study in regard to the time of its occurrence showed its presence both in the early and in the late stages. In only one case was it absent "early," and in this one it developed later. Elsberg found tenderness in every case studied, and in six cases it was most marked in the right iliac fossa. He emphasizes the interval of time which occurs between the development of pain and the appearance of tenderness. As has been said, tenderness forms one of the tripod of cardinal symptoms, upon which the majority of observers rest the diagnosis in adults, although its absence in rare cases has been noted by competent authorities.

RIGIDITY. Rigidity may be regarded as another important diagnostic symptom. It is almost invariably present. It was noted as being absent in only 1 of 32 cases of our series in which full data

[10] Archiv. Pediat., September, 1907.
[12] Archiv. Pediat., June, 1906.
[14] Lehrbuch. der Kinderkrankheiten, 12th ed.
[15] New York Med. Jour., May 4, 1901.
[16] Boston Med. and Surg. Jour., June 21, 1900.
[11] Jour. Amer. Med. Assoc., 1905, xlv.
[13] Rev. des malad. des enfants, 3d ed.

were given; and in one it was absent early but appeared later. Elsberg found it more or less marked in 14 cases. Its late appearance often ̤epends upon general peritonitis; but when found early, it becomes, in children, as in adults, a most valuable aid to diagnosis.

VOMITING. In 26 cases, vomiting was present twenty times, and absent six times. Of the 20 cases, it occurred as an initial symptom in 4; and in 4 others it was noted within four hours of perforation. In a large number of cases in which it was not mentioned, it was probably absent; and in the positive cases, it must often be a symptom of peritonitis rather than of perforation per se. Elsberg found it present early in four cases, occurring more frequently as the case progressed, but sometimes absent even in the presence of advanced peritonitis. In adults, Finney found vomiting with perforation in 26 of 68 cases. It will be seen, therefore, that, while vomiting is frequent and a symptom of some value always to be inquired for, it cannot be considered as characteristic.

DISTENTION. Distention was noted as being present in 19 cases and absent in 11. In 9 early cases (within six hours of perforation) it was present in 3 and absent in 6, while in 21 late cases (after six hours) it was present in 16 and absent in 5. In the other cases it was not recorded.

Distention was present in only 50 per cent. of the cases that recovered and in 91 per cent. of the cases that died. Some degree of distention was observed in 19 out of 22 cases in Elsberg's tables, although in only 10 was it of more than moderate degree. As one explanation of its early occurrence, it must be noted that distention is often present in an uncomplicated case of typhoid during the second or third week; while its frequency as a late symptom, taken in connection with its presence in so large a proportion of the fatal cases, simply indicates its significance as a symptom of peritonitis. Of 749 cases of typhoid fever in cildren collected by Morse, Adams, and Hand and Gittings, 209 (26.5 per cent.) showed the presence of distention during the course of the disease, apart from the complication of perforation. Curschmann believes that, while distention is more common in children than in adults, it is generally more moderate in degree in the former than in the latter. Distention, therefore, seems to be of scant value in the early diagnosis of perforation in either children or adults.

LIVER DULNESS. In sixteen cases the normal area of liver dulness was diminished or almost obliterated; 5 times this was noted in early cases. Elsberg noted it in only 5 cases, and emphasizes the fact that distention alone may cause a diminution in the normal area of dulness. Its value as a diagnostic sign is certainly greatly lessened by this fact. In adults Finney found obliteration of hepatic dulness in only 5 of 68 cases, and Shattuck, Warren, and

Cobb, in only 2 of 24 cases. Harte and Ashhurst consider it a most
unreliable symptom.   Diminution of liver dulness thus will · rarely
give material aid in the early diagnosis of perforation.

EFFUSION.   Effusion, as indicated by movable dulness in one or
both flanks, was noted as being present in eight of our cases.   The
failure to record it may be explained partly by the difficulty often
experienced in determining the presence of small amounts of fluid,
and partly by the impossibility of distinguishing between fluid
within the bowel or free in the peritoneal cavity, without movement
of the patient to his side, a procedure which is manifestly attended
with risk of spreading the peritoneal infection.   The absolute
determination of a rapidly increasing movable dulness in the flanks
which were previously tympanitic, is of undoubted value in corrob-
orating a diagnosis, but will rarely be available for establishing it.
Other abdominal symptoms not noted in our cases demand atten-
tion.   Curschmann refers to the condition of paralytic ileus and con-
sequent constipation, which is apt to develop soon after perforation.
While this would seem to depend upon a rapidly spreading infection
of the peritoneum, yet it may be noted some hours before the patient's
case has reached a surgically hopeless condition.   Taylor[17] considers
that inhibition of peristalsis forms one of the most important symp-
toms of the perforative accident.   In very few of the case records
which we have consulted was the presence or absence of peristaltic
sounds noted.   More careful attention to this point might furnish
valuable aid to diagnosis.

TEMPERATURE.   In 12 cases information as to the temperature
was entirely wanting.   In 10 cases the temperature was given at
varying times subsequent to perforation, but without statement as
to its height before perforation.   In 7 of these 10 cases it varied
from 100° to 103.8° F.   In the remaining 3 cases it was "subnormal."
In 6 cases it was stated that there was no change in the temperature
curve at the time of perforation.   In 5 cases there was a distinct rise
varying from 1° to 5°.   In 11 cases there was an immediate drop; this
averaged from 3° to 4°, one of 7° and another of 10° being recorded.
In one case there was a late drop of 6°.   Analyzing these figures,
we find that of 33 cases, there were 15 in which the temperature was
depressed at some time subsequent to perforation, and that in 11 of
these it was specified that there was an immediate drop.   In 6 cases
it was definitely stated that there was no change.   In 5 cases it was
stated that there was a rise at the time of, or shortly after, perforation;
and in 7 cases the temperature given, presumably at the time the
diagnosis was made, was fairly high.   In these there may have been
a slight drop, or one more pronounced with a subsequent rise.   In
only 33 per cent. of the cases was it specifically stated that there was
a pronounced initial drop in· temperature; so that, while this is

17 New York Med. Jour., February 1, 1902.

suggestive of perforation, it is probably absent in more than half the cases occurring in childhood.

We are more inclined than Elsberg to lay stress on an initial drop as a feature of significance in diagnosis. He found it recorded in only 4 of his 25 cases. It must not be forgotten that a drop in temperature may be a symptom of intestinal hemorrhage with or without perforation. In 2 of these 4 cases of Elsberg both hemorrhage and perforation were associated with the fall of temperature.

When we compare the conditions found in adults, we find authorities differing as to the frequency of this initial drop. Finney found it recorded in 14 of 68 cases. Harte and Ashhurst consider it significant but not diagnostic, while Harte,[18] in another communication, considers that a fall in temperature associated with sweating is a fairly constant accompaniment of perforation. The necessity for recording the temperature promptly after the first symptoms is obvious, as the subsequent rise may occur so rapidly as to mask the initial fall.

CHILL. The interesting observation of a chill at the time of perforation was recorded in 6 cases of our series. In view of the rarity of chills during an uncomplicated attack of typhoid in children, their occurrence during the second or third week should lead to careful examination of the patient for other symptoms of impending or existing perforation.

In adults, Scott found that in 16.9 per cent of his cases the occurrence of perforation was marked by a chill. Harte considers a chill infrequent, and Curschmann says that it occurs occasionally, especially in those cases with subsequent elevation of temperature.

PULSE. In 34 cases more or less satisfactory observations upon the pulse rate were furnished. In 8 there was no material change; in 8, there was an average rise of 39 beats per minute, the increase ranging from 12 to 70; in 9 cases the pulse was rapid when they came under observation, the rate ranging from 140 upward. Others were simply described as weak, rapid, or running. This condition was sometimes explained by an advanced peritonitis, but more often by initial shock. In 4 cases the rate varied only from 112 to 124; presumably in these cases the pulse showed no change. In 2 cases a slight slowing of the pulse was subsequently recorded, probably after an initial rise. Elsberg found decided change in the pulse in 15 cases; the rate increased and the quality diminished. In 5 cases this change was a sudden and early one. The majority of cases, therefore, in children, as in adults, show an increase in the rapidity of the pulse rate; and in a considerable number, a weakening in the quality of the pulse may be looked for as an accompaniment of intestinal perforation.

All writers seem to lay stress on the quickening of the pulse in

18 Boston Med. and Surg. Jour., July 18, 1907.

adults after perforation.   Harte and Ashhurst found a rise within
fifteen and twenty minutes in the vast majority of cases.   Briggs
considers the change of pulse of the greatest importance, and Cursch-
mann states that it may be the first indication of the grave signifi-
cance of abdominal pain of sudden onset.

SHOCK AND FACIES.   Does shock occur as an early symptom
of perforation in children?   Elsberg believes that they "seldom
show the sudden symptoms of collapse that are so frequent in adults."
The results we have obtained in our studies are not in accordance
with this view.   Shock was distinctly stated to be a marked symp-
tom in 10 out of 45 cases, the most prominent alteration being in
pulse and facies, and sometimes temperature—a rapid increase in
the first; a pinched, pale, anxious expression in the second; and a
fall in temperature, being the concomitant features.   In three cases
in which there was no shock the facies showed no change.   In
this connection we may mention the facies which is found in cases
of advanced peritonitis, the well known hippocratic type.   In 12
out of 14 cases of perforation observed late (after six hours) this
appearance was noted.   Curschmann considers that the change in
facial expression corresponds approximately with the local mani-
festations.

Taken in connection with the change in pulse and temperature,
change in facies assumes some importance; but alone, it is doubtful
whether it could be satisfactorily interpreted.

RESPIRATION.   The study of the data on respiration was unsatis-
factory.   Change in the rate is probably not of very great moment.
In five cases, some seen early and some seen late after perforation,
absence of abdominal respiration was noted—a symptom which is
not often looked for, or, at least, recorded, but one which we think
is probably of some importance.   In two cases it was stated that
abdominal respiration was present.   In only 7 of the 45 cases, there-
fore, are any records available.   We would emphasize the necessity
of more careful observation on this point.

LEUKOCYTOSIS.   Leukocytic counts were recorded in only 14
cases in our series; in 6 of these repeated observations were made.
In 2 of these 6 cases an increase of from 2000 to 3000 leukocytes
was observed after perforation, both cases ending fatally.   In two
others which recovered a rise, respectively, of 2000 and 7000 was
found.   In the remaining 2, both of which were fatal, a falling count
was recorded, which is in accordance with what has been observed
by other writers, namely, that the outpouring of leukocytes in the
effusion of peritonitis seems to act, at times, as a depleting agent to
the circulation.   Of the single counts taken within a few hours of
perforation, 3 were under 8000.   Of these cases, 2 recovered and 1
died.   Of the cases showing counts of 10,900 and 12,440 respectively,
one recovered and one died; while of the three which showed a
count in excess of 18,000, all recovered.

The number of these cases is too small to permit of conclusions being drawn, but they suggest that a falling count is unfavorable, while a high count or a rapidly rising count is of better prognostic significance. Elsberg found a sudden or gradual rise in 5 cases, and believes that frequent counts in the early stages may be of confirmatory value, but even here may lead the surgeon astray. We may conclude, therefore, that leukocytosis often accompanies the accident of perforation in children; and without being an infallible sign, yet it forms one of the features in the symptom complex. The attempt to establish a normal average of leukocytes throughout an uncomplicated attack of typhoid in childhood is difficult. Hand and Gittings found counts in 71 cases, which ranged from 5000 to 10,000; while 31 cases gave counts varying from 10,000 to 16,000. All of these occurred in uncomplicated cases.

Many authors, in writing of typhoid fever in the adult, are inclined to attach little importance to the leukocytic count in relation to perforation, owing largely to the wide range found in uncomplicated cases; others consider that the subject needs further study before any conclusion can be drawn. Shattuck, Warren and Cobb, Cushing,[19] Thayer,[20] and others attach much importance to a rise shown by hourly estimations.

BLOOD PRESSURE. The question of blood pressure at the time of perforation has recently received attention, but we have found no records of estimations in children. In adults results so far recorded show a distinct rise within two hours of perforation. After this time the pressure falls.

DURATION OF PERFORATION BEFORE OPERATION. There were 10 cases which were operated upon within six hours of perforation, of which 7 recovered and 3 died; of 10 cases operated on between six and twelve hours, 5 recovered and 5 died; of 8 cases operated on between twelve and twenty-four hours, 3 recovered and 5 died. Between twenty-four and forty-eight hours there were 8 cases, of which 3 recovered and 5 died. After forty-eight hours, there were 2 recoveries and 1 death.

There is here evident a steadily rising mortality after six hours. The recoveries in 2 of the late cases can be explained only on the theory of personal resistance to infection, lessened virulence of the intestinal bacteria, or more probably to partial localization of the infecting material. The same observation is made in late cases by Harte and Ashhurst.

Elsberg's figures show 100 per cent. of operative recoveries in the first eight hours, and 86.6 per cent. of recoveries in the first sixteen hours. After this time only 44.4 per cent. of recoveries are noted. All statistics confirm the value of early operation. The third hour was the most favorable period according to Harte and Ashhurst's tables; and after this a rising mortality was observed.

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[19] Johns Hopkins Hospital Report, viii.   [20] Ibid.

DESCRIPTION OF PERFORATION. *Number*. In 3 of our fatal cases there was a double perforation at the time of operation, in one of which one of the perforations was overlooked and discovered at autopsy. In a fourth case there were two perforations in the ileum and two in the appendix. This case recovered. In 8.9 per cent. of the cases, therefore, the perforations were multiple at the time of operation. Comparing with adults, we find that 12.5 per cent. of Harte and Ashhurst's cases showed multiple perforations.

Situation. In our cases of single perforations the site in 20 cases was within twelve inches, and in 5 cases within two feet, of the ileocecal valve. In 2 cases the notes record it "within a short distance," and in one case in the appendix; 81.5 per cent. of the cases, therefore, were in the ileum within a foot of its termination. In adults, Harte and Ashhurst found that in 73 per cent. the perforation occurred within twelve inches of the ileocecal valve.

Size. Nineteen of the perforations in our cases were of small size (pin point, one-sixteenth to one-tenth inches), and 10 were large.

Secondary Perforation. Three cases of secondary perforations were recorded in our series, all of which were fatal; of these, one was in the jejunum. This gives a percentage of 6.6 per cent. of secondary perforations. In Elsberg's series there were four instances of multiple perforation, and of these probably two, and possibly three, were secondary. This is interesting when it is noted that in Harte and Ashhurst's 362 cases there were only 12, or 3.3 per cent., of secondary perforations.

COMPLICATIONS. There were three cases of secondary perforation after operation. One had hemorrhages on the second and fifth days after operation; a second case had pleurisy, bronchopneumonia, and a fecal fistula. Another case, already mentioned, died of an undiscovered perforation, which was present at the time of operation. There were four other cases of fecal fistula developing after operation, all of which recovered, as did 2 cases of Elsberg's. These are of interest in connection with the observations of Hays[21] and others who have commented on the favorable course of cases developing fecal fistula after operation.

In the first 10 recoveries in Hays' practice there were 5 cases of fecal fistula, and in 16 similar cases of Harte and Ashhurst's series the mortality was only 12.5 per cent. There were two fatal cases of suppurating parotid bubo, one of which was bilateral, and three cases in which secondary abscess in the abdominal cavity developed, two of which were fatal. The latter were probably due to deficient drainage or unavoidable pocketing of infected collections of fluid. Two cases of postoperative intestinal hemorrhage were recorded, one of which recovered. In another case (authors') there was a hernia of several loops of bowel from the wound, following the removal

21 Jour. Amer. Med. Assoc., 1905, 1267; Penna. Med. Jour., January, 1908.

of loose gauze drainage five days after operation. Etherization was required for its reduction. We know of another case in an adult in which this accident occurred; caution should be exercised in the removal of gauze, for this reason. There does not seem to be a tendency for the formation of extensive adhesions in these cases when we consider that only 3 deaths out of 89 in Harte and Ashhurst's series were due to subsequent intestinal obstruction; no example of this sequel occurred in our own series and only one in Elsberg's.

ANALYSIS OF DEATHS. In our series there were 23 recoveries and 22 deaths, a mortality of 48.8 per cent. In Elsberg's 25 cases there were 16 recoveries and 9 deaths, a mortality of 36 per cent. Combining these figures, we find a total mortality in children of 44.28 per cent. The average mortality in adults as given by various authors equals about 75 per cent. It remains to consider fatal cases with respect to the time at which death followed operation. There were no deaths on the table. Eight patients (38 per cent.) died within twenty-four hours after the operation, as contrasted with 36 per cent. for this same period in Harte and Ashhurst's series. Two patients died on the second day and three on the third day. This gives 64.7 per cent. of the total mortality for the first three days, as compared with 76 per cent. for the same period in the Harte and Ashhurst tables. One died on the fourth, one on the fifth, one on the seventh, and one on the eighth day; and four patients lived respectively twelve, fifteen, twenty-three, and thirty-one days after operation. In these late cases death was due to secondary perforation, pneumonia, parotid bubo, secondary abscess, etc., some cases showing multiple complications. Of the three cases of secondary perforation, death occurred on the fourth, eighth, and twelfth days, respectively.

DIAGNOSIS. The important diagnostic symptoms which are shown by a study of our cases are: pain, tenderness, and rigidity, which in children, as in adults, are early in their development and fairly constant in appearance. Next in importance, because less frequent, but of significance when present, are a drop in the temperature, a rise in the pulse rate, and some degree of shock, often preceded or accompanied by vomiting, with perhaps a preceding or accompanying chill. A wave of leukocytosis will sometimes be recorded, and is at least as significant, if not more so, than in adults. Distention, and obliteration or diminution of liver dulness are of little value in making the diagnosis in children, while effusion is mainly of value in confirming it. Other points are an absence of abdominal respiration, inhibition of peristalsis, and possibly a rise of blood pressure, hitherto unstudied in early life. The accident of perforation may be simulated in children, as in adults, by a number of other conditions.

Appendicitis. We have operated for acute perforative appendicitis in typhoid fever in a child under the diagnosis of perforation. The

diagnosis between the two may usually be made from the fact that in appendicitis in typhoid fever, while the local symptoms are the same, their development is not usually marked by the same degree of constitutional involvement in the way of shock, fall of temperature, and rapid rise of pulse-rate as in perforation; nor is the course toward a fatal issue so rapid, if operation is not done. We have seen a case, in the service of a colleague (Hodge), of peritonitis without perforation, in a child who recovered from the operation. Such a case would be difficult or impossible of diagnosis from perforation, and operation would be equally indicated.

Hemorrhage. This may simulate perforation, or may precede or follow it. When pain is not present, it will not be difficult to distinguish. When pain and collapse are present before the appearance of blood in the stools, local and general symptoms must be carefully studied. The occurrence of previous hemorrhage would put the physician on his guard. The absence of rigidity and marked tenderness, and of leukocytosis, vomiting, and chill, are points in favor of hemorrhage.

Retention of Urine. While we know of no cases in childhood in which a distended bladder has caused pain suggestive of perforation, the occurrence of this condition is as easily conceivable, or more so, than in the adult, in whom it has to be reckoned with as a source of possible error in diagnosis.

Pneumonia and Pleurisy. A right-sided pleurisy or pneumonia very frequently simulates an inflammatory process in the right iliac fossa in childhood; examination of the base of the chest posteriorly should invariably be made when pain and rigidity are observed in the right side of the abdomen.

Flatus and Intestinal Colic. The local and constitutional symptoms of an inflammatory process will usually be wanting.

Rarer affections, perhaps simulating perforation, such as suppuration of mesenteric glands, intestinal obstruction of mechanical origin, intussusception, venous thrombosis, etc., need only be mentioned in this connection. Finally, it may be assumed that the accident of perforation is quite as likely to be overlooked in children as in adults. The difficulty in eliciting the symptoms in young children, both objective and subjective, is the greatest stumbling block in the making of a diagnosis.

THE TECHNIQUE OF OPERATION. It remains to analyze our statistics with regard to the technique employed: In the large majority of the cases the usual right iliac incision was employed. There is little difference in opinion as to its merits and the preference to be shown it. In three cases, probably on account of the condition of the patient, local anesthesia was employed. All of these cases ended fatally. While local anesthetics have undoubted advantages at times in adults, and are used practically as a routine by some operators (Hays), their employment in the young is open to

serious objection on account of the excitability of children and the
difficulty in controlling them. Elsberg prefers chloroform anesthesia
in children, but our own preference is for ether. In two cases the
appendix was removed for perforation. There are no special data
in our tables as to the type of sutures used to close the perforation.
A double row of interrupted Lembert sutures, applied in a direction
longitudinal to the bowel, is usually sufficient. A purse-string suture,
for a small perforation, reinforced, if necessary, and omental grafting,
to reinforce the sutures, for larger perforations may be used. As
Elsberg points out, primary resection of the bowel in cases with a very
large ulcer should never be done, if it is possible to avoid it. Indeed,
we question whether it should ever be considered in children. When
a perforation is too large to suture without the danger of occluding
the lumen of the bowel, it will be far better to establish an artificial
anus at once by primary enterostomy.

Primary Enterostomy. The favorable influence of the develop-
ment of a fecal fistula upon the prognosis, and the arguments based
thereupon in favor of primary enterostomy instead of suture of the
perforation at the time of operation, have been touched upon in the
consideration of complications. Hays recommends enterostomy
as a routine measure. Two cases in our series in which an artificial
anus was established died. Without doubt, enterostomy is an opera-
tion which is growing in favor, both for obstruction and for peri-
tonitis.

The question of its routine employment may still be considered
an open one. The near future will determine whether its dis-
advantages are offset by a decrease in mortality when it is adopted.
We are heartily in favor of anchoring the sutured segment of the
bowel in the wound, which was done in two of our cases with
favorable issue.

Treatment of Effusion. The fluid was removed by irrigation in
at least 19 cases in our series, with 11 recoveries; and by wiping or
sponging in 6 cases, with 4 recoveries Surgeons are still divided
as to the relative merits of irrigation and non-irrigation in the treat-
ment of abdominal effusions of infectious material. Most of the
arguments commonly used against it are valid in the consideration
of infections of a different type, especially those of appendicular
origin, when the infection is a slowly spreading one from a limited
focus, and when a large area of the peritoneum is not involved.
In perforations of the bowel of other types, and in gastric perforation,
especially from ulcer, when the peritoneum is often flooded with
intestinal or gastric contents and inflammatory exudate, we believe
irrigation furnishes the quickest and most effective means of remov-
ing this infectious material. Evisceration should never be employed
in children, whose susceptibility to shock is well known.

Rapidity of operation is even more essential in children than in
adults, on account of the danger of fatal shock. Our experience in
operations upon children leads us to indorse the opinion of Elsberg

that children bear abdominal and other operations well, if manipulations are not prolonged. Moreover, their recuperating powers after operation are greater than adults, and the reaction is more rapid and more complete.

Drainage. At least three cases were closed without drainage of the abdomen; and of these, two recovered. Tube or tube and gauze were used in the majority of cases, in which the character of the drainage was described. Since the widespread adoption of the principles of the Murphy treatment of diffuse peritonitis, we hear less about leaving infectious collections to the tender mercy of the peritoneum. A tube in the pelvis for existing or potential collections can do no harm, and a gauze strip to the region of the sutured ulcer, unless the bowel be anchored in the wound, is a wise precautionary measure.

Position After Operation. The Fowler position, either alone or in combination with continuous enteroclysis (Murphy), was occasionally mentioned as being practised, and was probably more frequently used. Its advantages are manifest. Nevertheless, the warning sounded by J. Alison Scott as to the wisdom of always employing it is to be borne in mind. He believes it to be occasionally harmful in typhoid cases, and in exhausted or delirious children it may well be found at times inexpedient. Unless contra-indicated by these conditions, however, we would advise it, as we have used it and seen it used to advantage.

In children, we cannot withhold either water or nourishment from the stomach as long as we can in adults; nor is it necessary, in the majority of instances, to do so. If the continuous enteroclysis is employed, the patient will suffer less from thirst. After six or eight hours, if there is no vomiting, we see no objection to administering small amounts of water by the mouth; and after twenty-four hours we may begin the administration of albumin water and pasteurized milk by the mouth.

CONCLUSIONS. Typhoid perforation is very rare under five years of age; after this period it is not infrequent, being about half as common as in adults. The favorite time of perforation is at the end of the second and during the third week. The diagnostic symptoms, in the order of their importance, are pain, tenderness, rigidity, fall in temperature, rise in pulse rate and collapse, vomiting, chill, and rising leukocytosis. The mortality after operation is influenced by the severity of the disease, rather than by the protracted course. It is lower under ten years of age than after this time. The mortality is lower in relapsed than in unrelapsed cases. The average mortality is somewhat less than 50 per cent. and at least 25 per cent. lower than in adults. The earlier the operation is performed, the better the prognosis. The technique of the operation does not differ materially from that advisable in adults, except in the use of a general anesthetic and the even greater necessity for rapidity in operation and avoidance of meddlesome surgery.

THE GENERAL MOVEMENT OF TYPHOID FEVER AND TUBERCULOSIS IN THE LAST THIRTY YEARS.

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PROFESSOR FINKELNBURG, of Bonn, estimates that the average length of human life in the sixteenth century was only between eighteen and twenty years, and at the close of the eighteenth century it was a little over thirty years, while today it varies in different countries from less than twenty-five to more than fifty years. The span of life since 1880 has been lengthened in civilized countries about six years. No two factors have contributed so much to the general results as the improvements of the air we breath and the water we drink. Indeed, we have ample evidence that with the introduction of public water supplies and sewers the general mortality in numerous cities during the past fifty years has been reduced fully one-half, the good effects being especially shown by a marked decrease in the number of deaths from typhoid fever, diarrhœal diseases, and consumption. The vital statistics of Great Britain furnish the proof,[1] and our experience with American cities confirms this conclusion.

The death rate in the city of Berlin has been reduced from 32.9 in 1875 to 16.4 in 1904; in Munich, from 41.6 in 1871 to 18 in 1906; and in Washington, from 28.08 in 1875 to 19.25 in 1907. The death rate in the city of New York in 1804 was 28 per 1000; from 1850 to 1854 it was 38 per 1000; while in 1906, in spite of the density of

[1] The following table shows the death rate from certain diseases per 10,000 of population in the English cities before and after the introduction of sanitary works (see Cameron, A Manual of Hygiene, 1874, p. 129):

|	Typhoid fever	Diarrhœa.	Consumption.
Bristol, before sanitary works	10.0	10.5	31.0
Bristol, after sanitary works	6.5	8.1	25.5
Leicester, before sanitary works	14.7	16.0	43.3
Leicester, after sanitary works	7.7	19.3	29.3
Cardiff, before sanitary works	17.5	17.2	34.7
Cardiff, after sanitary works	10.5	4.5	28.6
Macclesfield, before sanitary works	14.2	11.0	51.5
Macclesfield, after sanitary works	8.5	9.0	35.3
Warwick, before sanitary works	19.0	5.7	40.0
Warwick, after sanitary works	9.0	8.0	32.3
Stratford, before sanitary works	12.5	11.2	26.6
Stratford, after sanitary works	4.0	5.7	26.5
Ashby, before sanitary works	13.3	4.0	25.5
Ashby, after sanitary works	5.7	8.3	31.3
Dover, before sanitary works	14.0	9.5	26.5
Dover, after sanitary works	9.0	7.0	21.2
Croydon, before sanitary works	15.0	10.0	. . .
Croydon, after sanitary works	5.5	7.0	. .

the population, it was 18.9 per 1000, practically a reduction of 50 per cent., which, according to Walter F. Wilcox,[2] of Cornell University, means a saving of something like 46,000 lives each year in that city alone.

The mortality in the registration area in the United States has been reduced since 1890 from 19.6 to 16.2 per 1000 in 1905. Taking the census figures of a population of 33,757,811 in the registration area as a basis, the number of deaths in 1905 was 544,533; whereas at a rate prevalent in 1890, they would have been 662,654, a reduction of 17.8 per cent. and a saving in one year of 118,121 lives. If the same rate is applied to the entire estimated population in the United States of 82,574,195, the saving of human lives during 1905 alone would be over 290,000.

It has long since been known that rivers are always purer near their source; the amount of impurities increases as we descend the stream, since the water courses are the natural drainage channels of the country and the wastes of human life and occupations find their way into the streams. It is also well known that our large American rivers are the sewers and at the same time the source of water supply for nearly all the cities located on their banks. These cities show, moreover, a marked prevalence of typhoid fever, thus confirming what has been observed over and over again, that this disease, as also cholera, dysentery, and diarrhœal diseases can be carried from one town or city to another by means of inland waterways. Indeed, the question is one of extreme interest even to the residents along the Great Lakes; we know that large cities like Buffalo, Erie, Cleveland, Detroit, and Milwaukee discharge their sewage into the lakes, and we also know how Chicago and Cleveland suffered from typhoid fever visitations by contaminating their own water supplies. It is also a well-known fact that many of the river cities were obliged to resort to purification of their water supplies in order to arrest the ever-increasing typhoid fever wave.

INFLUENCE OF WATER SUPPLIES UPON TYPHOID FEVER DEATH RATES. For the purpose of determining the influence of public water supplies on the typhoid fever death rates in general, Mr. M. O. Leighton, Chief of the Water Resources Branch of the U. S. Geological Survey, very courteously complied with my request for a list of the principle American cities with a population of over 30,000 classified according to their water supply. Dr. Cressy L. Wilbur, Chief Statistician of Vital Statistics, Bureau of the Census, with equal promptness and accuracy, has computed the mean rate (not the average annual rate, which, however, differs only slightly for the five years 1902 to 1906), and has arranged them in a diagram (Chart I). The statistics, in spite of the many factors concerned in the dissemination of typhoid fever, conclusively show that the water

[2] Monthly Bulletin, New York State Dept. of Health, March, 1908.
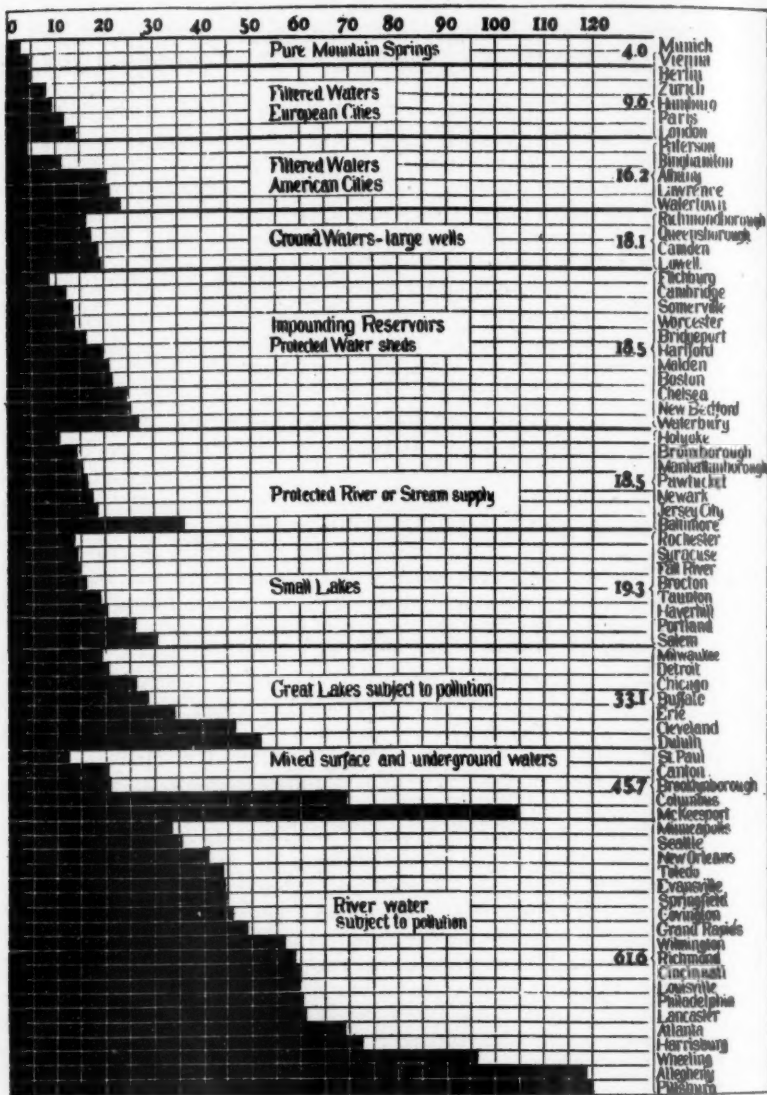
MEAN DEATH RATES FROM TYPHOID FEVER, 1902 TO 1906, IN 66 AMERICAN CITIES AND 7 FOREIGN CITIES. GROUPED, AFTER FUERTES, ACCORDING TO THE QUALITY OF THEIR DRINKING WATER. THE RATES FOR FOREIGN CITIES ARE TAKEN FROM JAMES H. FUERTES.

CHART I.

supply plays the most important role in the spread of the disease. A summary of the typhoid fever death rates is here given:

	Mean typhoid fever death rate from 1902 to 1906 per 100,000 of population.
4 cities using ground water from large wells	18.5
18 cities using impounded and conserved rivers or streams	18.5
8 cities using water from small lakes	19.3
7 cities using water from the Great Lakes	32.8
5 cities using both surface and underground water	45.7
19 cities using poluted river water	61.1

The rates for cities using unpurified river water fluctuate from 33.1 at Minneapolis to 122.1 at Allegheny, and even 133.1 at Pittsburg.

GENERAL MOVEMENT OF TYPHOID FEVER. Chart II illustrates the general movement of typhoid fever in different countries and cities, showing the percentage of decrease from the first to the last period shown. The period covered by Dr. Wilbur is (nearly) the last quarter of a century, and the rates are usually given for the successive five-year periods, beginning with 1881. The table shows that during the last twenty-five years the death rate from typhoid fever has fallen in these fourteen countries and cities from an average of 42.3 to 18.1 per 100,000, a reduction of 54.3 per cent. A more striking reduction could have been made if statistics going back as far as 1870 had been included. The typhoid rate in Berlin in 1872, at a time when that city was riddled with cesspools and supplied with polluted water, was as high as 142 per 100,000. On account of the incomplete mortality returns everywhere prior to 1881, we have deemed it best to exclude all older foreign statistics, and for similar reasons Dr. Wilbur begins his statistics for the United States with 1890.[3] We have likewise excluded Mr. Whipple's statistics, which tend to show that the death rate from typhoid fever in twelve States, including all of the New England States, New York, New Jersey, Maryland, California, Minnesota, and Michigan, has fallen from 55 in 1880 to 21 per 100,000 in 1905.

THE HYGIENIC VALUE OF PURE WATER: ANNUAL COST OF TYPHOID FEVER IN THE UNITED STATES. According to the Census of 1900, there were 35,379 deaths from typhoid fever during the

[3] Dr. Wilbur obtained the foreign statistics from data compiled from the international figures given in the last report of the Registrar General of England and Wales, from which report the rates for London are also taken. The rates for the cities of Paris and Berlin are given in the Annuaire Statistique of the City of Paris for the year 1904, and the rate of Berlin for the period 1901 to 1905 was supplied by Dr. Wilbur from data in his office. Dr. Wilbur laments the fact that "it is even now difficult to obtain a satisfactory statement of the number of deaths from such an important disease as typhoid fever in certain foreign countries, and the difficulty of securing comparative data increases as we go back. The disease was first accurately compiled by the Registrar of England in 1869."

TYPHOID FEVER

DEATH RATE PER 100,000 OF POPULATION

		RATE
10 20 30 40 50 60 70 80		
46.3	1890	U. S. +
32.12	1901 – 1905	
50.6	1881 – 1885	NEW
44.5	1886 – 1890	
29.3	1891 – 1895	SOUTH WALES
39.0	1896 – 1900	
21.5	1901 – 1905	
21.6	1881 – 1885	
17.9	1886 – 1890	ENGLAND
17.5	1891 – 1895	AND WALES
17.5	1896 – 1900	
11.2	1901 – 1905	
12.0	1881 – 1885	
9.0	1886 – 1890	NORWAY
5.1	1891 – 1895	
5.4	1896 – 1900	
5.3	1901 – 1905	
56.4	1881 – 1885	
39.7	1886 – 1890	
39.4	1891 – 1895	BELGIUM
24.3	1896 – 1900	
15.5	1901 – 1905	
23.5	1881 – 1885	
16.0	1886 – 1890	SWITZERLAND
11.1	1891 – 1895	
8.3	1896 – 1900	
5.3	1901 – 1905	
15.0	1881 – 1885	
25.2	1886 – 1890	JAPAN
20.6	1891 – 1895	
15.1	1896 – 1900	
11.6	1901 – 1905	
44.0 – 88.0	1881 – 1885	
22.0	1886 – 1890	PARIS
13.0	1891 – 1895	
12.0	1896 – 1900	
28.0	1881 – 1885	
14.0	1886 – 1890	BERLIN
8.0	1891 – 1895	
5.0	1896 – 1900	
5.0	1901 – 1905	
24.4	1871 – 1880	
18.9	1881 – 1890	LONDON
14.3	1891 – 1900	
32.6	1873 – 1882	NEW YORK
29.7	1883 – 1892	(Old City)
17.5	1893 – 1902	
65.7	1881 – 1885	
55.1	1886 – 1890	CHICAGO
80.7	1891 – 1895	
33.0	1896 – 1900	
27.7	1901 – 1905	
51.9	1881 – 1885	
39.0	1886 – 1890	BOSTON
23.6	1891 – 1895	
30.0	1896 – 1900	
22.4	1901 – 1905	
62.5	1881 – 1885	
68.0	1886 – 1890	PHILADELPHIA
43.2	1891 – 1895	
45.0	1896 – 1900	
49.9	1901 – 1905	

+ Registration area

CHART II.

census year throughout the United States; and based on an estimated mortality of 10 per cent., it is within reason to assume a yearly prevalence of 353,790 cases of this disease. If we calculate the average cost for care, treatment, and loss of work to be $300, and the average value of a human life at $5,000, we have a total loss in the United States of $283,032,000 from one of the so-called preventable diseases. Mr. George C. Whipple[4] presents some striking evidence to indicate that a loss of $10,000 for every death from typhoid fever is a conservative estimate, in which case the decrease in the "vital assets" during the census year of 1900 would amount to $353,790,000. Reduce the prevalence of the disease' one-half (which has been accomplished in Europe and our own country), and the question of the hygienic value of pure water will be answered from an economic point of view.

THE EFFECT OF IMPROVED WATER SUPPLY ON TYPHOID FEVER DEATH RATES. Chart III shows clearly the effect of change in water supply on typhoid fever death rates in seven American cities. Dr. Wilbur, of the Bureau of the Census, has given the death rate for a considerable time before and after the date of change, and also the average annual death rate before and after purification, and the percentage of reduction. From this table we learn that the combined average annual death rate from typhoid fever in cities with a contaminated supply was 69.4, and after the substitution of a pure supply it fell to 19.8 per 100,000, a reduction of 70.5 per cent.

The *Bulletin* for the month of April, 1908, of the New York State Department of Health contains an interesting article showing that the death rate from typhoid fever in ten cities of that State has been reduced 53.4 per cent. by improved water supplies.

It may be urged that improved methods of medical treatment are responsible for a considerable reduction in the death rates from typhoid fever, but when we see such a striking change immediately after the installation of filtration plants as in the case of the American cities shown in Chart III, and also more recently in Cincinnati and Philadelphia, we are forced to the conclusion that water purification plays the most important role by diminishing primarily the number of cases. It should be stated, however, that the effects are still more marked when combined with a good system of sewerage. The history of every sewered town shows a lessening of the typhoid death rate, and that the typhoid rate is always higher in sections of the same city supplied with makeshifts. In 1895 I pointed out that typhoid fever prevailed in Washington in 1 of 81 houses supplied with privies, and in only 1 in 149 of those connected with sewers, and offered as the only reasonable explanation that the sewers carry away the filth and germs that otherwise would contaminate the soil and ground water; but even if there were no wells,

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[4] The Value of Pure Water, New York, 1905, p. 5.

TYPHOID FEVER

DEATH RATES PER 100,000 OF POPULATION
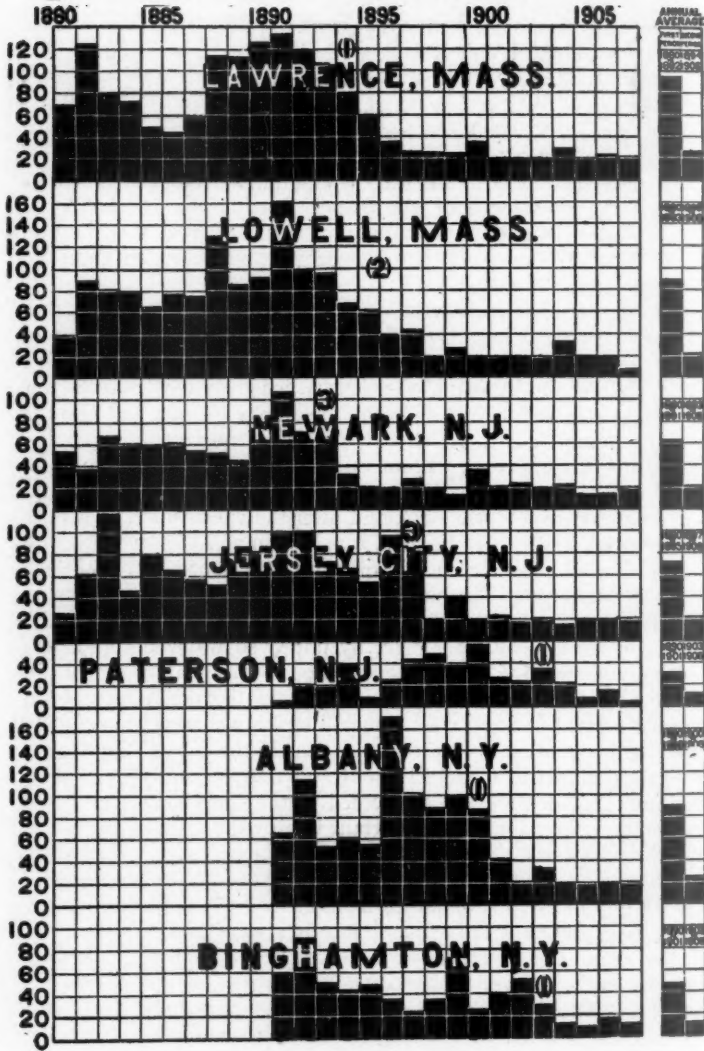
CHANGE IN WATER SUPPLY

(1) From unfiltered river supply to filtered river supply

(2) From unfiltered river supply to wells

(3) From polluted river supply to conserved river supply

CHART III.

these makeshifts are still a source of danger in so far as they favor the transmission of the infection by means of flies; nor can the possibility be ignored that the germs in leaky or overflowing boxes may reach the upper layer of soil and with pulverized dust gain access to the system.

I believe that about 80 per cent. of the cases of typhoid fever are water- and milk-borne, and about 20 per cent. may be spread through the agency of flies, personal contact, the consumption of raw oysters and shell fish raised in sewage polluted waters, or the eating of strawberries, radishes, celery, lettuce, and other vegetables and fruits which have been contaminated with infected night soil.

OTHER WATER-BORNE DISEASES. What has been said of typhoid fever is equally true of other water-borne diseases, like cholera, dysentery, cholera morbus, diarrhœal diseases, and the transmission of intestinal parasites, because the germs or ova of these diseases are present in the intestinal tracts and presumably also in sewage contaminated water. Mr. Allen Hazen,[5] one of the most distinguished experts on water purification in America, has conclusively shown that as the result of filtration plants in five cities supplied previously with an impure water, there was not only a reduction of 81 per cent. in the deaths from typhoid fever, but also a marked reduction in the general death rate. His computations clearly indicate that where one death from typhoid fever has been avoided by the use of a better water, a certain number of deaths, probably two or three, from other causes have been avoided. The truth of Hazen's theorem has recently been confirmed by Professor Sedgwick. It is a difficult matter to explain how water is connected with the deaths other than those from water-borne diseases, yet when we consider that water enters into the composition of the human body to the extent of 60 per cent., we are in a position to appreciate the sanitary acumen of Aristotle when he wrote in his *Politica:* "The greatest influence on health is exerted by those things which we most freely and frequently require for our existence, and this is especially true of water and air."

The general importance of the subject is now fully appreciated, and the North American Conservation Conference, on February 23,

[5] See a paper read at the International Engineers' Congress at St. Louis in 1904. Mr. Hazen found in five cities where the water supply had been radically improved:

	Per 100,000
A reduction in total death rate with the introduction of a pure water supply	440
Normal reduction due to a general improved sanitary condition, computed from average of cities similarly situated, but with no radical change in water supply	137
Difference being decrease in death rate attributable to change in water supply	303
Of this, the reduction in deaths from typhoid fever was	71
Leaving deaths from other causes attributable to change in water supply	232

1909, in the declaration of principles adopted the following in reference to Public Health:

"Believing that the conservation movement tends strongly to develop national efficiency in the highest possible degree in our respective countries, we recognize that to accomplish such an object with success the maintenance and improvement of public health is a first essential.

"In all steps for the utilization of natural resources consideration of public health should always be kept in view.

"Facts which cannot be questioned demonstrate that immediate action is necessary to prevent further pollution, mainly by sewage, of the lakes, rivers, and streams throughout North America. Such pollution, aside from the enormous loss in fertilizing elements entailed thereby, is an immediate and continuous danger to public health, to the health of animals, and, when caused by certain chemical agents, to agriculture. Therefore, we recommend that preventive legislation be enacted."

Having studied the effects of pure water supplies upon mortality rates, let us next consider the influence of pure air, removal of dampness, and general sanitation upon the movement of tuberculosis.

THE INFLUENCE OF SEWERS IN THE PREVALENCE OF TUBERCULOSIS. The records of the Health Office of the City of Washington show that during the last thirty years 14.5 per cent. of all the deaths occuring in the District of Columbia have been caused by pulmonary tuberculosis. The death rate, however, has gradually and constantly fallen from 446 per 100,000 in 1880 to 280 in 1907. The death rate from this disease in New York City has fallen in like manner from 433 to 271; in the United States at large, from 326 in 1880 to 183 in 1907 (Chart IV). These reductions began long before the combat of the disease was a subject for popular education. The question naturally arises, if these reductions have resulted independently of any attempt to control the source of infection, what are the chief factors concerned in bringing about this gratifying result? I know of no sanitary reforms which could have exerted a greater influence upon our general well-being than the introduction of sewers, improved water supplies, and the erection of sanitary homes. The marked reduction in the prevalence of consumption after the introduction of sewers observed in England over forty years ago, and also in the cities of Washington and New York and the country at large, may fairly be attributed to the prevention of air pollution and dampness. It is noteworthy that while the reduction in Washington, coincident with the introduction of sewers, amounts to 37.3, the reduction in Baltimore, an unsewered city, is only 24.7 per cent. It has been estimated by Erismann that a cesspool with 18 cm. contents is capable of polluting the atmosphere in the course of twenty-four hours with 18.79 cm. of impure gases, composed of carbonic acid, ammonia, sulphuretted and carburetted hydrogen,

and volatile fatty acids. In view of this fact, it requires no great stretch of the imagination to calculate the amount of air pollution which resulted from the 30,000 cesspools and other makeshifts prior to the introduction of the sewerage system in the city of Washington. The influence of impure air upon our physical well-being and the powers of resistance cannot be over-rated. As a matter of fact, individuals who contract tuberculosis in cities often arrest the disease by removal to the country, showing that an abundance of pure air is a very important factor in the treatment of the disease, simply because it promotes oxygenation of the blood, stimulates the appetite and nutrition, and thereby increases the general resisting power of the system. There can be no doubt as to the curative virtues of pure air, and hence we ought not to under-rate its preventive properties.
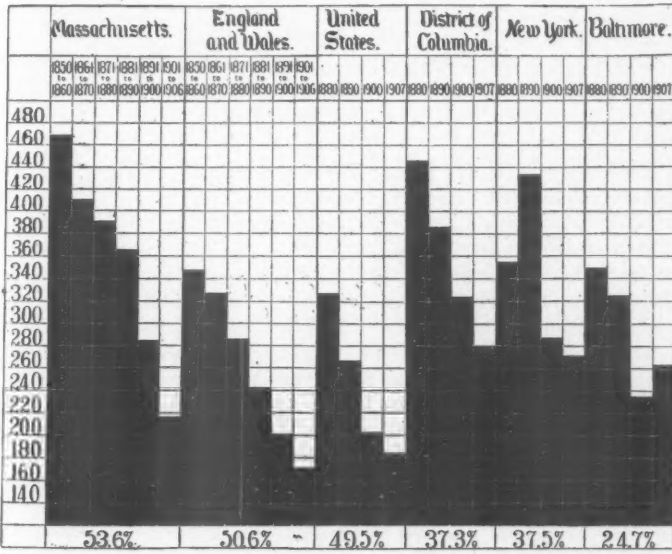
CHART IV.—General movement of tuberculosis. Death rates per 100,000 of population and percentage of reduction.

The observations of Dr. Bowditch, of Boston, as early as 1862, clearly indicate that there is a relation between dampness of soil and pulmonary consumption, and Dr. George Buchanan, the Medical Officer of the Privy Council of Great Britain, in 1867, supplied ample statistical proof that consumption became less frequent in certain towns after they had been sewered and the soil consequently drained. In towns like Worthing, Rugby, and Salisbury the deaths from consumption were reduced by 36 to 49 per

cent. It is true that such a marked reduction did not always follow, but in these instances it may be fairly assumed that the soil was previously quite dry and could not be materially affected by increased drainage.

The importance of a dry, healthful building site was appreciated by Hippocrates, since he, as well as Vitruvius, the father of architecture, referred in their writings to elevation as a desirable factor. One of the most striking illustrations of damp habitations as a predisposing cause to consumption has been recorded by Nowak, in the case of a prison in the vicinity of Vienna, containing on an average 200 inmates. Every convict is examined before his transport, and if found affected with incipient tuberculosis he is sent elsewhere. In spite of this precaution, the deaths number about fifty per annum, and the majority die from consumption. The prisoners are better fed in this institution than elsewhere, but the building rests on a wet soil, the walls are reeking with moisture, and the rooms smell musty.

The relation of dampness to consumption may be explained as follows: Dampness of soil, unless special precautions have been taken, extends by capillary attraction to the walls and renders the entire house damp. Damp air abstracts an undue amount of animal heat, lowers the power of resistance of the inmates, and predisposes to catarrhal affections, and these in turn render the mucous membrane, more vulnerable to the invasion of the tubercle bacilli. There is also reason for believing that the tubercle bacilli retain their vitality for a greater length of time in such an atmosphere on account of its humidity and excess of organic matter.

At all events, it has long been known that tuberculosis is far more prevalent in damp, dark, and insanitary houses. The children are anemic and as puny as plants raised without the stimulating effects of sunlight. The death rate is often double and treble that of other localities. While there are doubtless other factors which determine the frightful mortality, none are more potent than dampness, and deficient sunlight and ventilation. The tubercle bacillus clinging to floors and walls in carelessly expectorated sputum or droplets would be destroyed by a few hours' exposure to sunlight, but it finds in damp and dark basements, back-to-back houses, and yard and alley tenements suitable environments for its vitality and growth, and the other insanitary factors alluded to, together with the more intimate contact, materially increase the chance of infection.

If it should appear from the foregoing that I believe in the ubiquity of the tubercle bacillus, and that the question of environment should receive first and foremost consideration, I desire it to be understood that I am convinced, from the splendid labors of Professor Carl Fluegge, that the tubercle bacillus is not ubiquitous, and hence the task of stamping out the primary sources of infection is by no means hopeless. I believe, however, that until this is

accomplished, in this disease as in other infectious diseases, due attention should be given to all the causes likely to influence their spread, so that in our efforts to combat tuberculosis they may receive proper consideration.

I can scarcely do better than to conclude with the following quotation from the Report of the Conservation Commission:

"Since the greatest of our national assets is the health and vigor of the American people, our efficiency must depend on national vitality even more than the resources of the minerals, lands, forests, and waters. The average length of human life in different countries varies from less than twenty-five to more than fifty years. This span of life is increasing wherever sanitary science and preventive medicine are applied. It may be greatly extended. Our annual mortality from tuberculosis is about 150,000. Stopping three-fourths of the loss of life from this cause and from typhoid and other prevalent diseases would increase our average length of life fifteen years. There are constantly about 3,000,000 persons seriously ill in the United States, of whom 500,000 are consumptives. More than half this illness is preventable. If we count the value of each life lost at only $1700, and reckon the average earnings lost by illness at $700 a year for grown men, we find that the economic gain from mitigation of preventable disease in the United States would exceed $1,500,000,000 a year. This gain, or the lengthening and strengthening of life which it measures, can be had through medical investigation and practice, school and factory hygiene, restriction of labor by women and children, the education of the people in both public and private hygiene, and through improving the efficiency of our health service, municipal, State, and national."

EXPERIMENTS RELATING TO THE BACTERIAL CONTENT OF THE FECES, WITH SOME RESEARCHES ON THE VALUE OF CERTAIN INTESTINAL ANTISEPTICS.

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THE great number of bacteria present in the intestinal tract has for many years been a source of great interest to the physicians, and many investigations have been undertaken to determine the number and nature of these organisms. It has been demonstrated that the great proportion of the organisms consists largely of but

a very few varieties. The question as to the specific importance
of the flora in the intestines has also attracted considerable
attention.

It was Pasteur who first expressed the view that the bacteria of
the intestinal tract are essential to life. Nuttall and Theirfelder[1] fed
pigs obtained by Cesarean section on sterile food. The animals lived
and increased in weight. These investigators therefore concluded,
that the intestinal microörganisms are not essential to the main-
tenance of life. Levin[2] has likewise shown that in the Arctic
regions the intestinal tract of certain mammals is entirely free
from germs. On the other hand, Schottelius[3] has demonstrated
that in the chick the intestinal bacteria are essential to the normal
nutrition, and when fed on sterile food the chicks were retarded in
their growth and development. Madame Metchnikoff[4] obtained
the same results in experiments on tad-poles and Moro[5] on the larva
of the turtle.

If a certain number of bacteria are an essential factor in the
intestine in order to maintain life, it must also be conceded that a
large proportion of organisms present occasion fermentation and
putrefaction. It is easily conceived how an antagonism between the
cells of the intestines and the bacteria constantly exists, which ends
in the destruction of a certain number of organisms, and keeps the
bacterial growth within a certain limit. It is of interest to know
something of the number of bacteria in the intestinal tract under
normal conditions, so as to determine whether in certain diseases
there is an increase or diminution. With the object of diminishing
the number of intestinal bacteria, intestinal antiseptics have been
utilized for some time. In order to determine their value scientifi-
cally, however, it is important to know something as to the number
of bacteria infesting the intestinal tract in health. Two methods
of solving this problem are feasible. The first consists in making
plate cultures from a measured quantity of feces in various dilutions,
and counting the number of colonies. Investigations of this char-
acter have been made by Sucksdenf,[6] Fürbringer,[7] Stern,[8] Gilbert
et Dominic,[9] Salkowski,[10] Sehrwald,[11] Hammerl,[12] and Mieczkowski.[13]
The difficulty arising from this method of investigation is due to
the fact that even under normal conditions the number of bacteria

[1] Zeitschr. f. phys. Chem., 1895, xxi, 109; and 1897, xxii, 231.
[2] Ann. de l'institut Pasteur, 1901, p. 558.
[3] Archiv f. Hygiene, 1902, Band xlii, Heft 1.
[4] Annales d l'Institut Pasteur, 1901, xv, 631.   [5] Jahr. f. Kinderheilk , 1905, xii, 467.
[6] Archiv f. Hygiene, 1886, Band iv.
[7] Deut. med. Woch., 1887, Nos. 11 and 12.
[8] Zeit. f. Hygiene u. Infect.. Band xii, S. 88.
[9] Comptes rendus de la Société de Biologie de Paris, 1894, pp. 117 and 277.
[10] Virchow's Archiv, Band cxv, S. 339.
[11] Berl. klin. Woch., 1889, S. 413.
[12] Zeit. f. Biol., Band xxxv, S. 355.
[13] Mittheil. aus den Grenz. der Med. und Chir., 1902, Band ix, S. 405.

vary greatly, inasmuch as only a small proportion of those organisms sown in cultures develop at all, a large proportion dying.

Much more useful, therefore, is the method of counting not only the live, but also the dead organisms. This method was first introduced by Eberle[14] and further developed by Hellström.[15] The method was employed by Klein and de Lange,[16] who found 13 per cent. of the dried substance of the feces to be composed of bacteria. The value seemed so low that Strasburger[17] determined that the subject needed further investigation.

The method he employed is based on the principle that if the feces be macerated with water and then centrifugalized, the bacteria remain suspended in the fluid, while all the heavier substances fall to the bottom. If the fluid is now decanted, treated with alcohol so as to diminish its specific gravity, and again centrifugalized, the bacteria are thrown to the bottom and can be collected. Strasburger utilized this method in determining the number of bacteria in the feces, by weighing a certain quantity of feces, and afterward drying the bacteria obtained and weighing again.

From his investigations Strasburger arrived at the following conclusions:

1. The former methods of determining the number of bacteria in the feces are enveloped with great possibilities of error, and cannot give even relatively approximate results.

2. By means of this method it is possible to separate the bacteria from the feces, and weigh the same.

3. Under normal conditions one-third of the dried substance of the feces of a healthy individual ingesting a medium diet consists of bacteria.

4. The quantity of daily bacterial waste, dried, consists, in adults: (a) Under normal conditions, an average of 8 grams. (b) In dyspeptic intestinal conditions, an average of 14 grams, and even as much as 20 grams. (c) In chronic constipation, 5.5 grams, and at times even as little as 2.6 grams.

5. In chronic constipation the dried substance of the feces is usually abnormally small in quantity. The utilization of the food is far better, too, than under normal conditions. It is evident that the absence of the proper nutrient medium for the growth of the bacteria in the large intestine is the cause of this diminished growth.

6. In infants under normal conditions there is practically the same percentage of bacterial growth as in adults.

7. The total number of bacteria, estimated for a normal individual per day is 128,000,000,000.

8. Knowing the quantity of bacteria in the feces gives an insight into the bacterial development of the whole intestine.

[14] Centralbl. f. Bakt., 1896, i, S. 2.   [16] Ibid., 1896, S. 661.
[15] Ibid., 1900, Band xxvii, S. 834.   [17] Zeit. f. klin. Med., 1902, Band xlvi, s. 413.

This method affords us a means of determining the influence of intestinal antiseptics or the disinfecting activity of purgatives, and leads to the question, after all, whether it is possible to disinfect the intestine.   In regard to the value of intestinal antiseptics, Strasburger concludes that the most effectual method of reducing the bacterial growth of the intestine is by means of diet.   The value of intestinal antiseptics is quite doubtful.   It cannot be doubted that under certain conditions there may be a diminution in the growth of the bacteria, especially in the small intestine by means of intestinal antiseptics; but the effect is slight, and is rarely pronounced.   Other observers have come to conflicting views regarding the effect of intestinal antiseptics.

Bouchard[18] found that naphthalene, iodoform, and charcoal diminished the toxicity of the urine and stools, while Friedrich Müller[19] expressed the opinion that it is hardly possible to expect to disinfect the intestinal canal by drugs, and that there were no useful intestinal antiseptics.   Stern[20] found that calomel diminished the bacterial content of the feces in some instances and not in others.

R. Schuetz[21] observed the action of various drugs by passing certain easily recognizable saprophytic bacteria through the bowel, and noting the number of organisms that passed through alive during the period of administration of various antiseptics.   He found no special effect produced by the antiseptics.   Mieczkowski[22] found that menthol and tannopin given by the mouth diminished the number of colonies in specimens of feces from a fistula at the lower end of the ileum; with itrol and bismuth this effect was not produced. Schönenborn[23] found that naphthalene, itrol, thymol increased the bacteria, and that salicylic acid diminished the bacteria of the feces. Hoffman[24] showed that isoform when taken by the mouth is an excellent intestinal disinfectant and decreases the number of bacteria in the feces.   Herter[25] observes: "I have made some observations on the action of so-called antiseptics, and I have reached the conclusion that most of them do very little good in effecting a diminution of the putrefactive anaërobes of the intestines.   I have found in certain instances that salicylates, aspirin, and salol have exerted some action in diminishing the output of indican, but beyond this I have not been able to satisfy myself that the effect of intestinal antiseptics is pronounced."   The results of former investigations concerning the value of intestinal antiseptics differ to such an

[18] Leçons sur les autointoxicationes dans les maladies, Paris, 1887.

[19] Autointoxications intestinalen Ursprunges. Verhand. des Congress f. Innere Med., 1898, S. 148.

[20] Verhand. des Congresses f. Innere Med., 1898, S. 198.

[21] Archiv f. Verdauungskr., 1901, S. 58.

[22] Mittheilung aus den Grenzgeb. der Medicin und Chirugie, 1902, ix, 405.

[23] Inaug. Diss., Bern, 1903.

[24] Mittheil. aus den Grenz. der Med. und Chir., 1906, xv, 605.

[25] Bacterial Infections of the Digestive Tract, New York, 1907, p. 331.

extent that it appeared important to J. Dutton Steele[26] to investigate this subject more thoroughly than had been heretofore done. Steele points out the difficulties besetting this problem. Inasmuch as the intestinal antiseptics are seldom given alone, but usually combined with drainage of the stomach and intestine, and regulation of the diet, it is for this reason difficult to determine their true clinical value. Steele employed Strasburger's method of estimating the entire bacterial content in the stools in his researches, which he considers far in advance of all other methods. Bismuth salicylate and beta-naphthol, were the two antiseptics employed, and the subjects were free of any indications of intestinal disorders. His results were as follows: "The bacterial growth in the intestines is greatly diminished in normal individuals with the use of bismuth salicylate and beta-naphthol, and there is sufficient evidence to indicate that it is possible to check bacterial activity in the intestines by antiseptic drugs." Steele also expresses the opinion "that evacuation of the bowels combined with regulation of the diet are by far the most efficient means at our command to check excessive bacterial activity in the intestines."

The observations of Steele were not sufficiently extensive to draw very definite conclusions, so that it seemed most important to us to continue the investigations in the same direction. The technique employed in estimating the bacteria was that of Strasburger as modified by Steele. Steele describes this method as follows:

"The possibility of separating the bacteria from the rest of the feces depends on the fact that the bacteria are so nearly of the same specific gravity as distilled water that they cannot be centrifugalized out of a watery suspension of the feces, but remain suspended in the supernatant fluid. Taking advantage of this, the bacteria can be removed by washing with the centrifuge. Then, if the specific gravity of the wash-water is lowered by the addition of large amounts of alcohol, the relation of the bacteria to the fluid is changed to such an extent that the microörganisms can be readily centrifugalized out, separated, and weighed." "Unless the period of passage of the feces has been ascertained to be normal, it is better to mark the beginning and end of each period of examination by carmine. The use of the Schmidt diet is not necessary. The whole stool is saved. Unless the feces are liquid they are rubbed up with a known amount of distilled water until they are smooth and semiliquid and as homogeneous as it is possible to make them.

"Two portions of 5 c.c. are measured off with a pipette of large caliber, using for this purpose an ordinary 5 c.c. pipette with the tapering end cut off, and with the necessary correction made at the upper mark. One of these portions of 5 c.c. is put into a porcelain dish and dried over a water bath and later in a drying oven, in order

[26] Trans. of Assoc. Amer. Phys., 1907; and Jour. Amer. Med. Assoc., August 24, 1907.

to determine the dried weight. The addition of a little alcohol and thorough mixing will hasten the process of drying and prevent caking of the feces."

"The second portion is washed free from bacteria. This is done as follows: The wash-water is 0.5 of 1 per cent. HCl solution in distilled water. The acid increases the solubility of the salts and soaps of the feces. 100 c.c. of this solution is employed at the beginning of the washing. The feces are thoroughly mixed with the wash solution and then centrifugalized. The use of the water motor or electric centrifuge is almost essential. Each tube is centrifugalized for about one and one-half minutes, then the cloudy supernatant liquid is poured through a layer of gauze. This fluid contains the bacteria in suspension. All of the mixture (the wash-water and the feces) is centrifugalized the same way, and then the residue in the tubes is shaken up with more of the wash-water and centrifugalized again. This is repeated until the supernatant liquid after the centrifugalizing is transparent, showing that approximately all the bacteria have been washed out. If a smear is made of the residue at this point, it will be found that the bacteria are not entirely washed away, but are evidently very much reduced. They occur singly, while in the unwashed feces they are in great lumps and masses." "The suspension of bacteria is then mixed with a liberal portion of alcohol, and evaporated down slowly at a temperature of 40° to 50° C. until it amounts to not more than 50 c.c. in all. This takes approximately twenty-four hours. It is then mixed with at least twice its volume of alcohol, preferably absolute alcohol, although this is not absolutely necessary. This lowers the specific gravity of the fluid to such an extent that now the bacteria readily centrifugalize out." "The mixture is then centrifugalized until the supernatant liquid is quite clear. This takes thirty minutes or more for each tube. The residue, which consists of the bacteria, is washed with pure alcohol and is shaken up with ether to remove the fat; then it is again washed with alcohol. All of this washing is done by means of the centrifuge. The bacteria are next washed out of the tube with a little alcohol and evaporated to dryness and dried in the oven at moderate heat, dried in the desiccator, and weighed. Smears of the final preparation show that it consists of bacteria with a very few minute particles of other material. These particles are only visible with high power, and are very few in number, perhaps two to each field of the $\frac{1}{12}$-inch objective. They stain with methylene blue; Strasburger suggests that they are cellulose, which they may well be. At any rate, the error arising from the inclusion of these small particles in the dried weight of the bacteria must be very small, and is probably balanced by the bacteria that it is not possible to wash out of the residue in the first washing. During the preparation of the bacteria the first portion of 5 c.c. has been dried and weighed. We then know the dried weight of 5 c.c., the weight of the dried

bacteria in 5 c.c., the original volume of the stool, and the volume after the addition of a known amount of water. It is then easy to calculate the data that we desire, namely, the volume of the stool, its dried weight, the weight of the dried bacteria, and the percentage of bacteria in the dried weight."

In our experiments, extending over a considerable period of time, many examinations were made, both in normal individuals and patients suffering with digestive disturbances. Control experiments were made for several days without drugs, and the results compared with a period when the drugs had been taken for several days. The following drugs were employed: Beta-naphthol, bismuth salicylate, salol, aspirin, ichthalbin, lactobacilline, thiocol, bichloride of mercury, and thymol. In a certain number of cases the effect of diet alone was observed. The result of these examinations are summarized in the accompanying tables.

In order that the results of the various experiments may appear more clearly, the findings obtained by means of the same agent, in any particular individual, have been combined by us into a single average.

NORMAL CASES. These cases are represented in Table I.

The greatest reduction in the bacterial content was observed by means of diet alone. By the aid of a liquid diet, consisting mainly of fermented milk, this reduction averaged 16 per cent., and with a Schmidt diet, 13.7 per cent. Beta-naphthol reduced the organisms 9.9 per cent., whereas bismuth salicylate reduced them 8.8 per cent. Aspirin made an average reduction of 4.6 per cent., ichthalbin 4.2 per cent., while salol did not effect any reduction.

INDIVIDUALS AFFECTED WITH GASTRO-INTESTINAL DISTURBANCES. In Table II are represented the cases, suffering with gastrointestinal disorders. The results are rather conflicting. In a case of intestinal catarrh, neither salicylate of bismuth nor thiocol reduced the bacteria to any degree, while ichthalbin reduced them only 7.2 per cent. In another instance, a case of chronic colitis, bichloride of mercury reduced the bacteria 7.1 per cent.; they were not influenced by the use of salol; and a slight increase was observed after the use of bismuth salicylate. In a third instance, a case of marked hyperacidity with intestinal catarrh, a very marked reduction was observed under a restricted semisolid diet, a reduction of 18 per cent., whereas no reduction was effected with salol, aspirin, or thymol, which clearly indicates that we cannot assume that the action of the so-called antiseptic drugs is the same in diseases of the gastrointestinal tract as in normal individuals. From these observations we believe we are justified in concluding:

1. Regulations of diet, together with the evacuation of the bowels, is the most effectual method that we have at hand of reducing the excessively high bacterial content of the intestine.

TABLE I.—Normal Cases.

Name.	Diet.	Drug.	Number of examinations.	Average total feces.	Average dried weight.	Average dried weight (Bacteria).	Average per cent. (Bacteria).	Reduction.	Remarks.
				gms.	gms.	gms.			
J. D.	Regular	None	4	120	12.16	2.71	22.3		
J. D.	Regular	Beta-naph-thol	3	200	36.40	4.51	12.4	9.9	
B. E.	Regular	None	4	150	12.10	1.11	19.2	...	Observation only after stool was black.
B. E.	Regular	Bismuth sal-icylate	3	175	23.18	2.41	10.4	8.8	
B. E.	Regular	Salol	3	91	10.08	1.95	19.4	None	
F. L.	Regular	None	3	138	13.30	3.21	24.2		
F. L.	Lozak	None	4	85	12.70	1.04	8.2	16.0	
F. L.	Schmidt	None	3	102	10.40	1.09	10.5	13.7	
F. L.	Regular	Lactobacil-line	3	62	7.90	0.94	11.9	12.3	
G. H.	Regular	None	3	210	18.02	3.78	21.0		
G. H.	Regular	Ichthalbin	3	150	12.80	2.15	16.8	4.2	
R. S.	Regular	None	4	148	12.60	2.49	19.8		
R. S.	Regular	Aspirin	3	112	11.80	1.79	15.2	4.6	
R. S.	Regular	Salol	3	220	38.50	8.12	21.1	None	

TABLE II.—Individuals Affected with Gastro-intestinal Disturbances.

Name.	Diet.	Drug.	Number of examinations.	Average total feces.	Average dried weight.	Average dried weight (Bacteria).	Average per cent. (Bacteria).	Reduction.	Remarks.
				gms.	gms.	gms.			
D. R.	Regular	None	3	218.0	37.10	11.98	32.3	...	Case of intestinal catarrh.
D. R.	Regular	Bismuth sal-icylate	3	87.5	12.80	3.81	31.6	0.7	
D. R.	Regular	Thiocol	4	105.0	12.80	3.63	28.4	3.9	
D. R	Regular	Ichthalbin	3	114.0	17.40	4.36	25.1	7.2	
J. D.	Regular	None	3	76.0	10.50	2.89	27.6	...	Chronic colitis.
J. D.	Regular	Bicoloride mercury	4	120.0	15.70	3.71	20.5	7.1	
J. D.	Regular	Bismuth sal-icylate	3	208.0	26.50	9.06	34.2	None	
J. D.	Regular	Salol	3	172.0	19.40	4.88	26.1	1.5	
L. E.	Regular	None	4	69.0	12.60	4.80	38.1	...	Marked hyper-acidity with in-testinal catarrh.
L. E.	Regular semisolid	None	5	108.0	9.02	1.81	20.1	18.0	
L. E.	Regular	Salol	3	230.0	39.80	15.99	40.2	None	
L. E.	Regular	Lactobacil-line	4	112.0	11.10	3.99	36.0	2.1	
L. E.	Regular	Aspirin	3	94.0	12.40	4.37	38.3	2.8	
L. E.	Regular	Thymol	3	85.0	10.60	3.84	36.3	1.8	

2. Beta-naphthol and bismuth salicylate appear to be our most effectual intestinal antiseptic drugs in normal individuals, while aspirin and ichthalbin effect slight reduction, and salol gives no results whatever.

3. The results produced by means of intestinal antiseptics in patients suffering with gastro-intestinal disturbances, do not seem to be marked, whereas the best results are obtained by regulation of the diet.

In conclusion, we wish to express thanks to our laboratory assistant, Mr. A. Burton Eckerdt, for his valuable assistance in carrying out the experimental portion of this work.

A CASE OF CARCINOMA ON DIVERTICULITIS OF THE SIGMOID.

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AND

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CLINICAL REPORT BY H. Z. GIFFIN. In a previous paper,[1] Dr. W. J. Mayo and the authors of this paper reported the operative technique, the pathological findings, and the clinical histories in five cases of acquired diverticulitis of the sigmoid. Since that time several important articles have appeared upon this subject, notably those of Telling, Brewer, and Franke. Telling's paper[2] is an exhaustive study of 105 cases collected from the literature, including those cases operated upon, those discovered at autopsy, and a number found upon reëxamination of numerous museum specimens. Judging from the abstracts of these cases, 27 were operated upon. In only 12 of these was the condition recognized as diverticulitis at operation, or shortly afterward. Eleven of the 27 were thought to be malignant. In 5 of the 12 cases recognized as diverticulitis resection of a portion of the bowel was done. In 3 cases an inflamed diverticulum was resected, in 2 others a perforation was sutured, in 1 an abscess was drained, and in 1 an anastomosis was made. Brewer's paper[3] report as second operation upon a patient who had previously had an abscess drained (included in Telling's paper). This was the resection of a diverticulum acutely inflamed and about to rupture. The diverticulum was treated like an acutely inflamed appendix.

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[1] Surgery, Gynecology, and Obstetrics, July, 1907; Trans. Amer. Surg. Assoc., 1907, pp 240–244.

[2] Lancet, March 21 and 28, 1908.

[3] Jour. Amer. Med. Assoc., August 15, 1908.

Franke[4] reports one undoubted case, diagnosticated before operation and confirmed by pathological examination, in which resection was done. This case is not included in Telling's collection.

In the above list of cases there is but one instance of operation upon what proved to be carcinoma developing upon diverticulitis. The following case, which, through the kindness of Dr. C. Graham and Dr. W. J. Mayo, we have the privilege of reporting, is, therefore, of importance.

H B., aged sixty-eight years (A 18,633), male, gave a four years' history of intermittent complaint. At first there was a bloody dysentery of four or five days' duration, with some low abdominal pain. Then for a year or more the patient felt well. Three years previous to operation he was sick three days with quite a severe pain low in the left side of the abdomen, without vomiting, and with little other complaint. Six months previously he had a similar attack, with vomiting and chill, the pain being well localized in the left lower quadrant. There had been no complaint whatever between these attacks. One month before operation another attack occurred and a mass was palpated. A very slight loss of flesh had occurred in the latter weeks, and there was more or less soreness in the side and an occasional chill. The general condition was quite good. The mass persisted to the time of operation, and was as large as an orange. The patient had noticed some blood in the stools during the last month, and a few times the passage of small hard masses of feces, which stained the water about them a reddish color. In attempting to arrive at a clinical diagnosis Dr. Graham placed carcinoma first and diverticulitis second.

The patient was operated upon January 21, 1909, by Dr. W. J. Mayo. A carcinoma was found at the juncture of the descending colon and sigmoid. It had evidently had its origin in a preëxisting diverticulitis. A number of diverticula were also found without carcinomatous change. The tumor had perforated into the left iliac fossa, and an abscess, very much like an appendiceal abscess, existed, with extensive adhesions. It contained a few drams of sterile pus. The entire descending colon and iliac portion of the sigmoid, including the infected peritoneum, were removed. A lateral anastomosis between the splenic flexure and the pelvic sigmoid was made. Drainage was provided by rubber tissue leading through the incision down to the anastomosis and by two stab wounds, each with two rubber-tissue drains.

The case from the literature above referred to is reported by Hochenegg. The following abstract is quoted from Telling's paper (Hochenegg,[5] 1902): The patient, aged seventy years, had suffered from constipation. A carcinoma of the sigmoid flexure was resected; the flexure showed for a great distance numerous cherry-

⁴ Deut. med. Woch., xxxv, No 3.   ⁵ Verhand. der deut. Gesells. f. Chir. ?1

sized diverticula, filled with somewhat hard, plastic fecal matter. The carcinoma was regarded as resulting from the chronic irritation and ulceration of the diverticula, due to the retained feces.

Two other cases are reported by Telling which illustrate the association of carcinoma and diverticulitis. These were discovered at autopsy (Telling,[6] 1907): Male, aged fifty-eight years. Constipation and flatulence for many years. Symptoms worse, with loss of weight, and for some time previous to admission. Shortly after this the patient developed general peritonitis and died. At the necropsy there were found the following: (1) Perforating appendicitis. (2) Multiple diverticula of the lowest four inches of the sigmoid flexure. This was thickened, increasingly from above downward; it was fibrofatty in nature, and was most marked opposite the mesosigmoid. The diverticula were, for the most part, currant-sized, contained fecal concretions, and in many cases entered the appendices epiploicæ. But all were not so situated; some were between the layers of the mesosigmoid. In some, ulceration had occurred, and this had led to the chronic perisigmoiditis, and consequent partial narrowing of the gut. The diverticula had "lipped" openings. (3) At the splenic flexure was a narrow, stenosing carcinoma, with a papillary surface toward the lumen of the bowel. It practically encircled the gut and caused partial obstruction. In it were to be made out several "pockets," suggesting those noted in the sigmoid flexure, but this origin could not with certainty be determined. At the edges of the growth were several "cysts" filled with mucus. The gut between the splenic and sigmoid flexures presented no diverticula. "This case is interesting from the presence of three different lesions which may, however, be connected. Assuming that the chronic constipation caused the diverticula, the thickening of the bowel from the chronic diverticulitis would increase the constipation, and the resulting irritation to the bowel may have occasioned the carcinoma above, even if this was not directly due to the irritation of diverticula at this spot. The increasing obstruction of the bowel from the carcinoma was probably a predisposing cause to the perforating appendicitis." The second case, an aged female, was reported by Stierlin:[7] Multiple diverticula were found above a stenosing carcinoma of the sigmoid flexure.

Diverticulitis of the sigmoid has been brought to our attention frequently enough within the last few years to make us think of its possibility in every case of abdominal cramp, especially when symptoms or signs are later localized in the left lower abdominal quadrant. Most of all should it be considered in a history of recurrent attacks over a period of years, and when a mass is palpable. One is quite safe in excluding a primary carcinoma if the history of attacks runs back for a year or two, thus arriving at a tentative diagnosis

[6] Loc. cit.   [7] Corresbl. f. Schweitzer Aerste, xxxii, p. 749.

of carcinoma on diverticulitis in case the signs point to present malignancy. Only a provisional diagnosis will, of course, be possible in any case. The weight may remain close to normal even after malignancy has developed, but the general condition of the patient will be better if carcinoma be developing on a preëxisting inflammatory condition than one would expect with a primary cancer of equal size.

. If one can ascertain how long a tumor has existed, the relation between this and the patient's general condition may be of assistance in pointing either to a primary carcinoma or carcinoma on diverticulitis.

Not infrequently cases are met clinically which give a history of one or two attacks of abdominal cramp localizing quite definitely in the left iliac fossa. No mass is palpable, but pressure on the gut is painful. Most likely a number of these cases are diverticulitis, and their future history will bear careful watching. Again, if surgical pathologists will carefully examine all specimens of carcinoma of the large bowel for the possible occurrence of diverticula, something will be done toward clearing up the question of the actual frequency of malignant change in diverticulitis.

PATHOLOGICAL REPORT BY LOUIS B. WILSON. When the specimen was opened longitudinally a fungoid carcinoma about 6 cm. in transverse diameter presented itself. The base of the tumor was on the mesenteric side of the viscus. In examining the specimen it was found possible to pass a probe into a deep pocket which penetrated the carcinoma well within its margin. The specimen was fixed in Kaiserling's fluid and then sectioned longitudinally. Four diverticula were found. The one which had been determined by probing before fixation is shown in Fig. 1. Its lining mucosa had been somewhat damaged by the insertion of the probe, yet its character can be readily seen in the photograph. The carcinoma completely enveloped the diverticulum. It is possible that another diverticulum may have been present at the point occupied by the centre of the tumor mass, as is indicated by some fine dark lines at this point in Fig. 1. It is, however, impossible to say that this is the case, since the mucosa has been so completely destroyed. Fig. 1 also shows very nicely the enlarged glands within the mesentery, which were found, on microscopic examination, to be filled with carcinomatous metastases.

The section knife revealed two diverticula placed laterally to the one just described, and just within the border of the carcinoma. These are shown in Fig. 2. It will be seen that they have penetrated the muscularis, and a large amount of inflammatory tissue has been thrown out in the subserosa, causing adhesions which have been torn away by the operative procedure. In these two the mucosa is well preserved, and it is only their inner ends that are affected by car-
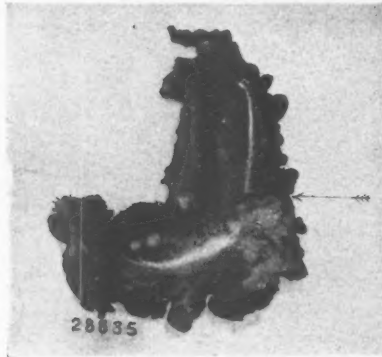
Fig. 1.—Carcinoma on diverticulitis of the sigmoid. The specimen was fixed in Kaiserling's solution, sectioned longitudinally and photographed, immersed without staining. The arrow points to the diverticulum, most of the mucosa of which has been destroyed by necrosis. Above the arrow is seen the main mass of the carcinoma, within the centre of which are some faint lines indicating what was probably a diverticulum. To the left are seen the transverse sections of glands containing carcinomatous metastases. × 2/3 diameters.
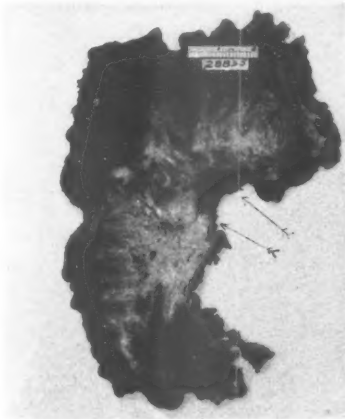
Fig. 2   Fig. 3

Fig. 2.—Carcinoma on diverticulitis of sigmoid. The same specimen and technique as Fig. 1. The arrows point to two diverticula just in the edge of the carcinoma. Much of the connective-tissue adhesions have been torn away, as is shown by the gap in which the arrows are placed. × 2/3 diameters.

Fig. 3.—Carcinoma on diverticulitis of sigmoid. The same specimen and technique as Fig. 1. The arrow points to the diverticulum lying completely outside the carcinoma. × 1½ diameters.

cinomatous tissue. A fourth diverticulum was found on the side opposite the preceding two, and completely outside of the carcinomatous area. This is shown somewhat magnified in Fig. 3. This diverticulum is exactly like certain ones previously described by me.[8] It is a false diverticulum, that is, all the walls of the viscus are not carried outward, but the muscularis is penetrated by the coats lying within it. A large amount of inflammatory connective tissue has developed around the base of the diverticulum. The distal end of the pocket contained a small, dark, fecal concretion when it was opened. This specimen is particularly interesting in that it shows various stages in the destruction of previously formed diverticula by a carcinoma developing thereon. The abundant connective tissue formed in the wall of the sigmoid about the outer extremities of the diverticula was, no doubt, the result of a peridiverticulitis, which long preceded the carcinoma. It is, of course, impossible to say whether the chronic irritative process was the only etiological factor in the development of the malignant growth. The conditions, however, would seem to be somewhat analogous to those in the stomach when a chronic ulcer has become the base of a developing carcinoma, a process which pathologists and surgeons are now coming to recognize as the usual association in gastric carcinoma. It would seem important that we go over most carefully all carcinomas of the colon for remains of diverticula. There is no doubt that these anomalies are much more numerous than we have hitherto supposed, and their presence may account in some measure for the relative frequency of carcinoma of the colon as compared with that of the small intestine. Difficulty in determining their presence is due to the fact that most cases of carcinoma coming to operation or autopsy are so far advanced that evidence of preëxisting diverticula may have been destroyed in the necrotic centre of the tumor. Certain specimens of colon carcinoma which I have examined recently strongly suggested the presence of diverticula, but it was impossible to determine their exact etiological relationship owing to the mentioned fact.

CERVICAL RIB AND ITS RELATION TO THE NEUROPATHIES.

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THE congenital anomaly, development of a cervical rib in human beings, may reasonably be interpreted as an evidence of atavism, since in embryos of lower vertebrates every vertebra has a rib

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[8] Loc. cit.

attached to it. In reptiles, these embryonic elements proceed to the formation of true ribs; in man, the first seven cervical ribs remain rudimentary. The occasional abnormal formation of a cervical rib originally possessed purely an anatomical and morphological interest, and passed as a curious anomaly, sometimes discovered in autopsies as accidental findings. Clinical significance was given to the condition when hard tumors were demonstrated in the supra-clavicular fossa of living subjects, giving rise to symptoms of press-ure upon vessels and nerve trunks, with, in many cases, prompt subsidence of these phenomena after extirpation of the tumors. These osseous formations were found to be cervical ribs. More recent research in this direction includes cervical rib among the so-called stigmas of degeneration, or rather anomalies of develop-ment, and assigns it a certain place as a combined factor in various neuropathic disturbances. The occurrence of this anomaly was known to Galen, but the knowledge of the present is essentially based upon the monograph of Wenzel Gruber,[1] published in 1869, which contains a compilation of the recorded cases, supplemented by personal observations. The oldest description of cervical rib is probably given by Hunauld,[2] in 1742.

In the great majority of cases the bearer of a cervical rib is not conscious of its presence; but an originally harmless malformation of this kind may act as a compressing tumor, as the result of trau-matic periosteitis.[3] Aside from traumatism, the late and slow devel-opment of the disturbances, which rarely manifest themselves before adult age, has been referred to loss of "padding," through con-stitutional diseases, such as anemia and rheumatism (bringing the bony protuberances in direct contact with the nerves and subclavian artery, followed by disturbances in the corresponding area of inner-vation and blood supply), and to the retraction of the pulmonary apices in healed tuberculous lesions. In each of the four cases observed by Nickol[4] in Senator's clinic, a tuberculous affection of the pulmonary apex was found on the same side as the cervical rib, and in the bilateral cases of cervical rib catarrhal affection was revealed over both apices.

The symptoms caused by a cervical rib may be: (1) Of purely nervous origin; (2) neuromuscular; (3) of circulatory character; (4) of a local nature. The first two groups of symptoms, which are closely related to each other, are those to be especially discussed in this paper and illustrated by my own observation. As is usual in bilateral cases, the symptoms were originally confined to the side of the larger rib.

The patient is aged twenty-eight years. Her history, both family

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[1] Ueber die Halsrippen des Menschen, St. Petersburg, 1869, Mém. de l'acad. imp. d. sc., vii Series, 13, No. 2.

[2] Mém. math. et phys. d. l'acad. r. d. sc., lvii, 1742.

[3] Wien. klin. Woch., 1896, No. 6.   [4] Inaugural Dissertation, Leipsic, 1906.

and personal, is entirely negative from a neuropathological point of view. Symptoms referable to the cervical rib date apparently from the patient's eighth year. She then began to suffer pains in the left shoulder radiating down the arm; the entire left upper extremity would become paroxysmally numb. She noticed also gradual development of an indefinite sense of discomfort of the left shoulder; likewise, a protrusion of the left shoulder blade, which, when pressed upon, gave rise to varying degrees of pain and numbness through the left arm. These symptoms persisted. In the course of a few years there was added a certain inability properly to use the left index finger, noticed particularly in piano playing, and gradually a certain lack of dexterity of the left hand. When about eighteen years old, the patient noticed that certain movements of the arm, for example, arranging her clothing, necessitating placing the arm behind her, caused flexor spasm of the muscles of the forearm and hand. At this time there was no weakness and no wasting of the muscles. In October, 1904, the patient noticed weakness in grasp and in finer movements of the left hand. Steadily progressive atrophy of the small hand muscles developed; both thenar and hypothenar surfaces were involved. Soon after, a coldness of the left upper extremity, particularly from the elbow to the finger tips, was at times subjectively felt and objectively demonstrated. It was noticed that when the hand became temporarily cold, muscular weakness became more pronounced for the time being. Paroxysmal attacks of objective pallor and coldness occurred independently of the position of the extremities.

My examination in 1904 revealed areas of hypesthesia and hyperalgesia irregularly distributed over the left forearm and hand. These areas varied, and finally disappeared, leaving, as the only sensory disturbance, an area of hypesthesia for all forms of sensation in that part of the forearm and hand corresponding to the inner cord of the brachial plexus, particularly the ulnar distribution (Fig. 1). In 1904 the left hand presented in appearance the typical *main à griffe*. The following comparative measurements (1904 to 1908) show that the atrophy itself had remained about the same for the past four years (previous to operation):

	Inches.	
	1904	1908
7 inches inferior to the acromial end of the clavicle, circumference of the upper forearm:		
left	9⅜	9½
right	10½	10½
5 inches below the bend of the elbow:		
left	6½	7¼
right	8⅛	8¾
2 inches above the wrist joint:		
left	5½	5½
right	5¾	6
Circumference of the palm, fingers extended:		
left	7¼	6¾
right	8	8

I noted some atrophy of the left pectoral muscles in 1904. The same condition existed in 1908 (Figs. 2, 3, and 4).
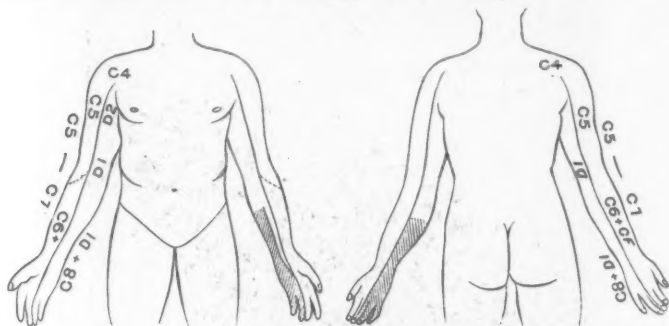
FIG. 1.—Diagram showing the peripheral distribution of the roots of the brachial plexus. *C*1 to *C*8, area of nerve supply of the first to the eighth cervical roots; *D*1, area of supply of the first dorsal root. The shaded area on the left forearm shows the area of diminished sensation—eighth cervical and first dorsal roots—in author's case of cervical rib. This is the area usually affected in cases of cervical rib.

Right   Left

FIG. 2.—Showing muscular atrophy of the left forearm and hand. (Author's case.)

Physical examination revealed an osseous tumor on the left side two inches outside of the sternal insertion of the sternocleidomastoid muscle and extending vertically two inches from the upper clavicular

Right   Left

Fig. 3.—Showing atrophy of the left palmar muscles.   (Author's case.)

Fig. 4.—Showing particular atrophy of the interossei of the left hand.   (Author's case.)

border.   On the right side a far smaller eminence was found in about the same position (Figs. 5 and 6).   The x-rays disclosed scoliosis

FIG. 5.—Showing the positions above the clavicles at which the osseous growths (false ribs) were seen and felt.   (Author's case.)

FIG. 6.—Showing the relative positions of the inner and lower borders of the scapulæ The high scoliosis is also evident.   (Author's case.)

extending from the sixth cervical to the fifth dorsal vertebra, with convexity to the left side; compensatory scoliosis below. Bilateral cervical ribs were seen attached to the bodies of the seventh cervical vertebræ, articulating at their distal ends with a facet from the upper border of the first dorsal ribs. On the left side the supernumerary rib measured about one and three-quarters inches; the right one, about two inches in length. At the angle of the cervical rib there was an upward protuberance far more marked on the left side. The scoliosis, as well as the angular displacement of the rib, give it greater prominence and greater interference with the plexus on that side. The third normal rib on the left side was markedly smaller in diameter than its fellows. The radiogram was made by Dr. L. G. Cole; by means of it I was able in 1904 to confirm my diagnosis of cervical ribs (Fig. 7).

Right   Left

FIG. 7.—Radiogram of the author's case made before removal of the false ribs. The supernumerary ribs are indicated by arrow heads. Note the greater prominence of the left cervical rib. Scoliosis is evident. (The radiogram was made by Dr. L. G. Cole, New York.)

In my examination, in 1904, the radial pulse on both sides showed no change in volume. I failed to observe the position of the subclavian artery at that time. During the last year I have observed a diminution in the volume of the radial pulse on the left side; the subclavian artery pushed upward by the false rib, crosses the rib anteriorly; slight compression of the vessel against the rib obliterates the pulse. A distinct bruit but no thrill is heard over the subclavian on the right side only. As will be observed, the vascular symptoms are slight. These observations were made also just prior to operation for removal of the ribs.

It was clinically possible to demonstrate upon careful palpation the exact location of the three roots formed by the fifth, sixth, seventh, and eighth cervical and first dorsal nerves in their relation to the supernumerary rib on the left side. The fifth and sixth were felt lying superiorly about at the summit of the rib and somewhat anteriorly, freely movable. The seventh and eighth were more inferiorly, although pushed upward by the rib. The eighth cervical and first dorsal were deep between the supernumerary and the first normal rib, and could hardly be reached. Pressure with the finger tip upon each of these bands of fibers produced a numbness in the area of the arm supplied by each. The position of the eighth cervical and first dorsal pressed upon as the fibers were, by the cervical rib, explained doubtless the hypesthesia in the ulnar distribution, as well as the muscle atrophy of that nerve supply.

The weight of the patient since 1904 has remained unchanged. In 1906 she gave birth to a child. During the course of her pregnancy, her subjective sensory symptoms, she tells me, were more troublesome. The confinement was normal; the offspring normal, except showing apparent secondary lesions of specific infection. Shortly before the delivery, specific manifestations appeared on the mucous membranes, buccal and vaginal, of the mother. The history of the case points to infection after a second marriage in 1905. Periodic outbreaks of specific symptoms affecting the mucous membranes have since appeared, yielding rapidly to treatment. The patient began, about six months before operation to observe a weakness in the right index finger and a certain want of dexterity in executing the finer movements of the right hand. A slight numbness likewise was complained of occasionally in the right thumb, thus indicating involvement of the right upper extremity. Within the next few months numbness in the right lower extremity, and pains in the calf muscles, were complained of, and I have been able to detect at times a slight but manifest weakness in the flexors of the toes of the right side; no sensory and no electrical changes.

In May, 1908, my patient submitted to the operation for removal of the cervical ribs. The operation was performed by Dr. Alfred S. Taylor, of New York. We found the relations of the rib on the left side and the plexus roots as had been determined by palpation (Fig. 8). The relation of the cervical ribs to the first normal rib had been shown by the x-rays. The subclavian artery crossed the first rib, anterior and below the end of the cervical rib, the roots of the plexus lying over the supernumerary rib. The eighth cervical and first dorsal roots crossed the distal end and were undergoing the most tension and pressure. This coincided with the clinical symptoms. The relation of the structures was about the same on both sides. The upper roots were so situated as to be but little compressed. The roots appeared normal to the naked eye. A few fibers of the scalenus muscle were inserted into the upper surface of the extra

rib on both sides. The subclavian artery crossed the first rib anterior to and below the end of the cervical rib; the roots of the brachial plexus were lying over the cervical rib. The cervical ribs on both sides articulated with the bony process attached to the upper surface
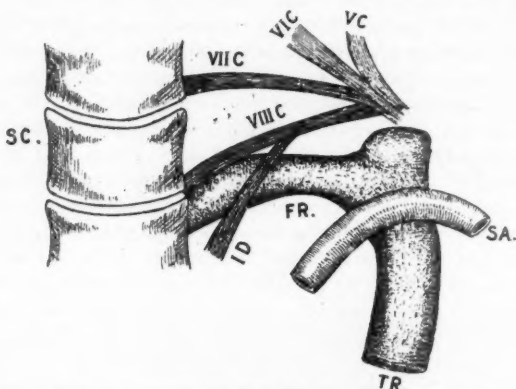
FIG. 8.—Diagram showing the anatomical relationship of the false or cervical rib (*FR*, to the subclavian artery (*SA*); first or normal rib (*TR*); spinal column (*SC*); fifth, sixth), seventh, eighth cervical and first dorsal nerve roots (*VC, VIC, VIIC, VIIIC, ID*).

of the first rib. There was a strong fibrous capsule between the two, but very little motion. Fig. 9 shows the size and shape of one of the false ribs after removal. Immediately after the operation there was paralysis of almost the entire brachial plexus distribution,
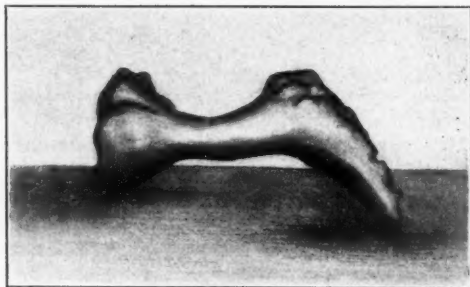
FIG. 9.—One of the false ribs after removal (natural size).

both sensory and motor, affecting particularly the left side. In the course of a week, motion and sensation began to return, and there has been slow but constant improvement. At present, over one year after the operation, there is still very considerable atrophy and still very slight sensory changes along the lower forearm on

the inner side. Fig. 10 shows a radiogram taken after the removal of the cervical ribs; it should be compared with Fig. 7. The details of the technique of the operation will be published later by Dr. Taylor.

Cervical rib as a factor in the estimation of obscure nervous symptoms is entitled to greater attention than it has received. In those cases in which these ribs are discovered, the patient complaining of nervous disturbances, those diseases of the nervous system should be borne in mind which are known to develop upon the basis of an abnormal predisposition, a neuropathic diathesis. At the same time, the hereditary and family relations must be taken more seriously into consideration. Cervical rib was observed in two

Right   Left

FIG. 10.—Radiogram of the author's case, made after surgical removal of the false ribs. (The radiogram was made by Dr. L. G. Cole, New York.)

sisters, by Israel.[5] In all the cases of cervical rib which are brought to the physician's attention, the entire nervous system should be examined. The condition is often combined with other nervous diseases—especially syringomyelia—which are not due to the cervical rib, but arise on the common soil of the same neuropathic diathesis (Oppenheim[6]). Hysteria and hypochondria have been observed in patients having a cervical rib, and Oppenheim mentions two cases presenting symptoms of gliosis, in whom a direct compression of the recurrent nerve had been assumed on the basis of the

[5] Berl. klin. Woch., 1901, 1189.
[6] Lehrb. d. Nervenkrankht., 1905, vol. i; Berl. klin. Woch., 1901, No. 47.

recurrent paralysis. Sensory disturbances which are not limited to the region supplied by the brachial plexus point to the presence of other nervous affections. The coincidence of nervous diseases, arising upon the basis of congenital anomalies of development, assumed by Oppenheim, is of especial interest in patients having cervical rib.

ANATOMY AND EMBRYOLOGY. Cervical ribs correspond to the processus costarius of mammals, and originate through the failure of fusion between the processus costarius and lateralis, with continued growth of the former (Aron[7]). Their location is at the anterior aspect of the transverse process of the sixth and seventh cervical vertebræ, which possesses an independent bony centre. (The transverse processes of the cervical vertebræ consist of an anterior and a posterior segment, between which lies the foramen transversalium. The anterior shank of this transverse process corresponds to a costal rudiment, and has accordingly been designated as processus costarius.) If the processus costarius of the seventh cervical vertebra is abnormally well developed, the result is a cervical rib. As a rule, in these cases, a supernumerary rib of unequal development is found on either side, one side presenting a short stump, the other a more or less well developed rib.

At a very early period of fœtal life the "Anlage" for the ribs is found along the entire vertebral column, from the highest to the lowest segment. The development of true ribs is confined to the thoracic region, whereas the "Anlage" in the cervical and lumbar vertebræ undergoes retrogression into short rudiments, which may still be recognized by the peculiar configuration of the transverse processes. In certain rare cases, accessory ribs have been observed in the lumbar region, but this anomaly is without clinical importance. There is no case on record in which a supernumerary rib had developed in both lumbar and cervical regions in the same individual. Genuine cervical ribs articulate almost invariably with the seventh cervical vertebra, and are composed, as a rule, of a head, neck, and tubercle. The course of ossification presumably resembles that of normal ribs, in which the centres make their appearance in the head and tubercle about the age of fifteen years, fusion with the rest of the rib taking place about eight years later. In the majority of the cases the anterior extremity of the cervical rib is curved off downward at a right angle, the bone becoming continuous with the first rib.

Cervical ribs discovered accidentally at autopsies, or in living individuals, are by no means rare; Pilling,[8] in 1894, was enabled to compile 139 authentic cases. Women seem to be somewhat more subject to them than men; Ranzi[9] found 17 cases in women against

[7] Berl. klin. Woch., 1892, p. 826   [8] Inaugural Dissertation, Rostock, 1894.
[9] Wien. klin. Woch., 1903, No. 10..

12 in men, and Bernhardt's[10] observations were to the same effect. Among the 42 patients operated upon, collected by Keen,[11] there were 31 females and only 11 males. The fact that cervical ribs are, as a rule, bilateral (67 per cent.) has been established by the x-rays; one is always better developed than the other, and usually at a higher level, as is evident in my own case. A complete cervical rib, extending from the spinal column to the sternum, is very rare. There are two cases on record in which two cervical ribs were found on the left side, and likewise but two cases in which symptoms were well developed on both sides. My case makes the third. The anomaly was most frequently discovered in patients past twenty years of age, and some patients had actually passed the half-century mark (Rutkowski,[12] Keen's case). In rare cases the symptoms date from childhood (my case).

Gruber's classification has been so frequently repeated that the more recent grouping suggested by Blanchard[13] is given here, after Kammerer:[14] First group, in which there is a complete supernumerary rib attached to the sternum; only one autopsy recorded. Second group, in which the cartilage of the supernumerary rib is united with the cartilaginous end of the first dorsal rib; also a rare occurrence, but more common than the first variety. Third group, in which the two extremities of the rib are developed as bony structures, but the intermediate portion is represented by a band of fibrous tissue. Fourth group, in which the two extremities of the rib are developed, but not united by a fibrous band. The anterior extremity may be of bone or cartilage, and it may be attached to the sternum or to the cartilage of the first rib. The posterior extremity is practically always attached to the seventh cervical vertebra, and its anterior end is either free or united to the first rib by an articulation or by bony tissue. Fifth group, in which the supernumerary rib is represented only by a segment attached to the vertebra and there is no indication of an anterior extremity.

The clinical symptoms of cervical rib are more readily understood upon the basis of a similar classification, being without exception referable to pressure upon important adjacent structures, namely, the roots of the brachial plexus and the subclavian artery. As a rule, both the nervous and vascular phenomena develop gradually, up to several years, but the onset may be abrupt, probably determined by traumatism.

NERVOUS DISTURBANCES. Cervical rib must be admitted as an etiological factor in local neuralgias of the arm and hand. In a

[10] Berl. klin. Woch., 1901, p. 1189.

[11] The Symptomatology, Diagnosis, and Surgical Treatment of Cervical Ribs, AMER. JOUR. MED. SCI., 1907, cxxxiii.

[12] Zur Diagnostik der Halsrippen, Ztschr. f. klin. Med., 1906, 60.

[13] La revue scientifique, 1885, i, 724.

[14] Cervical Ribs, Annals of Surgery 1901, 34.

general way, the symptoms caused by interference with the brachial plexus, which originate not so much as the result of pressure, but rather of stretching and pulling of the plexus above the supernumerary bone, are not in proportion to the size of the rib. Small cervical ribs may cause considerable trouble, and large ribs may be relatively harmless, since the nerves pass across the first portion of the cervical rib, and the further development of the bone is accordingly a matter of indifference for the plexus (Seiffer[15]). The disturbances caused by compression of the brachial plexus are rather sensory than motor. The first of all nervous symptoms is pain, radiating down the arm, sometimes as far as the hand (my case). After a period of paresthesia, hyperesthesia, or hyperalgesia, there follows a diminution of sensation. In regard to the sensory loss in cases of cervical rib, analgesia is said, as a rule, to be more pronounced than tactile anesthesia (see Fig. 1), suggestive of a root lesion, as first pointed out by Sherrington. Ataxia may be present, but complete paralysis has not been reported.

The typical sensory change of cervical rib consists in the loss in the distribution of the eighth cervical and first dorsal root, more particularly the latter, which may be exclusively involved. It is this nerve which supplies the fibers to the nerve of Wrisberg, or lesser internal cutaneous nerve, the smallest of the branches of the brachial plexus. It will be remembered that the nerve of Wrisberg is distributed to the integument of the inner side of the arm, the back part of the lower third as far as the elbow; and that it connects with the posterior branch of the internal cutaneous nerve. The ulnar nerve distribution is likewise involved.

Owing to involvement of the ulnar nerve fibers, the inner side of the forearm is likewise usually hypesthetic. The exclusive involvement of this area alone should direct attention to the possibility of cervical rib. The involvement of the fibers from the eighth cervical and first dorsal branches, resulting in hypesthesia along the ulnar surface of the forearm, is well explained by Howell. The first dorsal route, as it becomes part of the brachial plexus, passes almost directly upward on the neck of the first thoracic rib; it thus easily comes in contact with the false supernumerary rib, curving downward and forward. As Howell has observed, the longer ribs cause less pressure than the shorter ones. The first dorsal route lies on the upper surface of the neck and body of the first rib, and in lateral movements of the neck and head may be compressed against the seventh cervical rib, though when the head is held in a straight position the nerve may not be in contact with the cervical rib.

NEUROMUSCULAR DISTURBANCES. The symptomatology of cervical rib may closely resemble that of a lesion of the first dorsal branch of the brachial plexus. A connection between wasting of

[15] Monats. f. Psych. u. Neurol., vol. xvi, Heft. 4.

the intrinsic muscles of the hand and the presence of cervical ribs was first pointed out by Thorburn[16] in 1904. Two cases of atrophy of the intrinsic muscles of the hands, reported by him, are shown by the x-rays to be associated with the presence of cervical ribs. Lewis Jones,[17] upon the basis of x-ray examinations of all his accessible former patients with this type of muscular atrophy, agrees with the above assumption of cervical rib playing an important part in the production of atrophy of the muscles of the hand. "Well-marked cervical ribs were found to exist in 10 out of 14 cases examined." Moreover, an extra rib was present on both sides in eight patients who presented symptoms on both sides; whereas there was a cervical rib on the affected side alone in two patients with wasting of one hand. As pointed out by Keen, the muscles involved point to the lower cords of the brachial plexus, and not to the upper. According to him, the wasting is especially marked in the thenar and hypothenar muscles, but the interossei and forearm muscles may be affected, and there may be loss of power in the muscles of the shoulder and the chest. As to the cause of the muscular atrophy, it seems to be more rational to seek this in the compression of the nerves rather than in the diminished blood supply. This view seems to be borne out by the results of surgical interference, and is substantiated by my own observation.

VASCULAR DISTURBANCES. Circulatory symptoms may be entirely or nearly absent, even in well-marked cases of cervical rib, as in the cases reported by Fischer[18] and myself—for the reason that the subclavian artery passes in the normal way over the first rib. There is generally a well-marked pulsation in the neck, but this is not invariably the case. Aneurysms of the subclavian artery, in the portion lying between the rib and the clavicle in the supraclavicular space, and thrombosis in the arteries of the upper extremity have been observed as the result of pressure from a cervical rib. Grave nutritive changes are of uncommon occurrence, but endarteritis obliterans and gangrene of the finger tips have been reported as a result of arrest of circulation. In milder cases the temperature of the arm on the side of the rib is lower, and the hand has a tendency to become pale and bloodless on trifling exertion. The subclavian vein does not suffer as does the artery, since its anatomical position gives it abundant space.

LOCAL EVIDENCES. A pathognomonic local sign of cervical rib does not exist. A more or less vertical osseous protuberance above the middle of the clavicle, in the lateral cervical region, especially when combined with superficial pulsation of the subclavian artery, and pressure symptoms in the brachial plexus, may be regarded as

[16] The Seventh Cervical Rib and its Effects upon the Brachial Plexus, Medico-Chir. Trans., 1905, 88, p. 109.
[17] Cervical Ribs and Atrophy of the Hand, Quart. Jour. Med., 1908, i, 2.
[18] Deut. Ztschr. f. Chir., 1891-92, xxxiii.

a presumptive, but hardly as a positive sign. A guarded diagnosis of cervical rib under these circumstances should be confirmed by means of the x-ray plate.

Scoliosis is almost invariably associated with cervical rib. Their relationship as to cause and effect is in dispute. I believe that the scoliosis is not a simple mechanical effect of the cervical rib. A careful study of the anatomical features of the cases reported in the literature does not support the view that the scoliosis results from the mechanical displacement. Among 400 cases of scoliosis, Helbing demonstrated by x-rays that 2 per cent. were accompanied by cervical rib. This author describes two characteristic features of this form of scoliosis, high position of a very rigid scoliosis, and turning or mal-position of the head with asymmetry of the face skeleton and resulting difference in the contour of the neck and shoulder on the two sides.

Levi[19] in his report of a case of bilateral cervical rib, in a girl having multiple sclerosis, warns us against a premature diagnosis of cervical rib on the basis of the x-ray picture. The transverse process of the seventh cervical vertebra is so prominent in x-ray exhibits that in two other cases the diagnosis of cervical rib of the first degree was rendered by experienced x-ray specialists. One of these was a case of syringomyelia, the other of plexus neuritis, and the diagnosis of cervical rib was proved to be erroneous by comparison with a series of radiograms of normal cases. In this connection it is of interest to note Jones' comment on a camera photograph of a bony specimen in the Museum of the Royal College of Surgeons (see Hinds Howell's paper[20]), which has cervical ribs on both sides, but the one on the left side is short and irregular in shape, and lies in close relationship to the first true rib. "Such a rib photographed by x-rays in the living subject would probably give an impression on the plate of an overgrown transverse process of irregular outline, an appearance which is sometimes seen in x-ray photographs of the cervical region."

ASSOCIATION WITH NERVOUS DISEASES (DEGENERATIVE TYPE). There are several cases on record of syringomyelia (Borchardt,[21] Oppenheim, Marburg[22]), one of multiple sclerosis (Levi), and one of cervicobulbar palsy (Spiller-Gittings[23]), in individuals having cervical ribs. One of Murphy's[24] patients had suffered for thirteen years from an enlargement of the thyroid gland. In cases of this kind it is permissible to assume the presence of some defect of the central nervous system from the embryonic period, the cervical rib repre-

[19] Neurol. Centralbl., November 1, 1894.
[20] Symptoms Produced by Seventh Cervical Ribs, Lancet, June 22, 1907, i.
[21] Symptomatologie u. Therapie d. Halsrippen, Berl. klin. Woch., 1901, p. 1265.
[22] Syringomyelie und Halsrippe, Wien. klin. Rundschau, 1906, xiii.
[23] New York Med. Jour., October 5, 1908.
[24] The Clinical Significance of Cervical Ribs, Surg., Gyn., and Obs., October, 1906.

senting merely another congenital anomaly. Precisely as in syringo-myelia, other changes have been repeatedly met with which had to be interpreted as congenital anomalies of development. Cervical ribs may be associated with a symptom complex which cannot be referred to compression of the plexus, but must be interpreted as manifestations of an hysterical or hysteroneurasthenic type. Oppen-heim believes that when this combination is more carefully sought for, numerous cases of cervical rib will probably be found in which the nervous symptoms, even when localized in the arm of the same side, cannot be referred to compression. Syringomyelia in these cases is not uncommonly introduced by a scoliosis, which causes the cervical rib to protrude, giving rise to traction upon the brachial plexus, with the concomitant symptoms.

SEQUELS OF CERVICAL RIB IN THE SKELETON. Scoliosis has been frequently reported in association with cervical ribs, the con-vexity being, as a rule, toward the side of the extra rib, or toward the larger rib in bilateral cases. Four cases of cervical rib, observed by Garré,[25] all presented primary scoliosis in an unusual location, namely, at the transition of the cervical rib into the thoracic spinal column (see my case). Drehmann,[26] who made a special study of this type of scoliosis, arrived at the conclusion that the majority of his cases (10) of primary cervicodorsal scoliosis, limited to a few vertebræ, were due to supernumerary ribs. The motor paresis and gradual muscular atrophy observed in the scoliosis of cervical rib are ascribed by Hoffa to the constant pressure upon the brachial plexus. In view of the small number of clinical cases of cervical rib hitherto published, the relatively high percentage of coincident scoliosis is certainly noteworthy; but while there is an etiological connection between a special form of scoliosis and cervical rib, this does not imply that every cervical rib is necessarily followed by scoliosis. Hochenegg[27] calls attention to the fact that congenital scoliotic curvatures of the cervical vertebral column are very common additional findings in cases of cervical rib.

TREATMENT. In the various desultory writings upon the sub-ject of supernumerary rib there is no approach to unanimity of opinion as to treatment. It is only too generally conceded that conservative measures are indicated when no symptoms are present or only those of moderate pressure on the plexus. Removal of the rib, according to some observers, remains as an emergency procedure when palliative measures have failed. It is true that cervical rib is frequently associated with central nervous disease, to which the symptoms may be largely referable. A recent writer on the subject, Hinds Howell, maintains that palliative measures be tried even in severe cases. In the case reported by Kammerer the atrophic

[25] Ztschr. f. orthop. Chir., 1903, ii.   [26] Allgem. med. Ctrztg., 1906, No. 2.
[27] Lehrb, d. spez. Chirurgie, 1907.

muscles of the left arm were in the same condition three and one-half months after the pressure on the plexus had been removed. Howell reports two cases and Furnrohra[28] a third, in which operation was followed by complete paralysis of the arm. The plexus not having been ostensibly damaged, it is claimed that the nerves reacted thus to surgical traumatism. It is possible that the report of these cases was given too soon after operation. One year at least should elapse before one may judge of what degree of repair to expect. Removal of the rib in Marbourg's case was followed by rapid progress of the trophic and sensory disturbances, with progressive symptoms of syringomyelia. This writer is opposed to operation in complicated cases. One of Israel's patients was operated upon for a severe brachial neuralgia without motor disturbance. The operation had no effect whatsoever upon the neuralgia, and a serratus paralysis was added when the patient was seen a few months after. Beck[29] is likewise of the opinion that the removal of a cervical rib which causes no disturbance is unwarranted. Rawling[30] says, on the basis of two cases operated upon by him and two others operated on in St. Bartholomew's Hospital, that complete removal is usually a matter of the greatest difficulty, due to the small area of operative field and the numerous muscular attachments which the rib receives. In removing these, many small but troublesome vessels are divided. Complete removal, with ablation of the projecting part of the bone only, may be followed by a temporary relief of the symptoms, which return, however, as the result of new bone formation at the free extremity of the resected rib. My own observation does not substantiate this statement. In Beck's case the symptoms returned with undiminished vehemence three months later, and another operation became necessary. Jones mentions two instances illustrating a return of pain and muscular weakness and due to new bone formation. It is therefore imperative that the removal be complete, that is, that the periosteum be removed together with the rib.

It is doubtless true that the removal of a cervical rib requires an experienced and dexterous operator. The very marked advance, however, in modern surgical technique, especially in what might be called neurological surgery, leads us to a greater degree of boldness in handling surgically those cases of cervical rib in which serious disturbances on the part of the nervous or vascular system manifest themselves. The achievements of later-day surgery in resection of nerves, especially parts of the brachial plexus, warrant a more radical procedure and assurance of better results than have hitherto attended operations. In view of the rapidity with which compression symptoms of cervical rib sometimes develop, it may be

[28] Quoted by Hinds Howell.
[29] Jour. Amer. Med. Assoc., June 17, 1905.   [30] Ibid.

questioned whether the removal of these ribs be advised when their presence becomes clinically demonstrable.

The salient points in the case which I have presented might be summed up as follows: (1) Onset of symptoms at an unusually early age (seven years). (2) Severity of symptoms, which were practically limited to the nervous system. (3) Hypesthesia in the region supplied by the inner cord of the brachial plexus (ulnar distribution). (4) Progressive atrophy of the small muscles of the hand, including the thenar and hypothenar eminences. (5) Cervico-dorsal scoliosis. (6) Stationary character of the symptoms referable to the cervical rib, in the absence of surgical intervention. (7) Demonstration of the exact location of the roots of the brachial plexus in their relation to the supernumerary rib on the left side; digital pressure upon each producing numbness and tingling in corresponding area of arm. (8) Diminution in size of the third normal rib on the left side, well shown in the radiogram. (9) Beginning symptoms due to pressure on the opposite side. (10) Surgical removal of both cervical ribs.

THE INTERPRETATION OF APHASIA.

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General Considerations. The novel and revolutionary views of Pierre Marie, the vigorous defence of the classic theories by Dejerine, the noteworthy revisions of the subject by Moutier and by von Monakow, and the brilliant discussion before the Neurological Society of Paris have aroused a keen interest in aphasia, and have given an especial zest to its study. Like others, I have studied anew the material at my disposal, and have endeavored to lay aside, for the time being, previously acquired impressions and beliefs. The interpretation of aphasia is most important, as this affects vitally our conceptions of cerebral function in its entirety. That which follows presents in brief the point of view at which I have arrived. The cases used in illustration are, of course, cited merely in outline.

Whatever view we may be disposed to take with regard to the nature of aphasia, whether we accept the older or classic view, that aphasia consists of two primarily and essentially different elements, sensory and motor, or whether we hold with Marie that aphasia is a unity the essential characteristic of which is an impairment of the faculty of speech comprehension, it will best serve the purposes of

[1] Read at the International Medical Congress, Buda-Pest, September 1, 1909.

an analytical study if we begin with general considerations.   Clearly
our first task is to consider the feature, if any, common to all forms
of aphasia.   That such a feature exists is practically admitted by all
writers.   If we begin with an analysis of so-called motor or Broca's
aphasia, we find, of course, first, a loss or impairment of the power of
speaking, but also in addition an impairment of the power of com-
prehending speech, both spoken and written.   I need only cite the
well-known position of such stanch exponents of the classic view
as Dejerine as to the existence of alexia, and of Thomas and Roux as
to the failure of the comprehension of spoken speech.

Dejerine tells us that in true cortical motor aphasia or Broca's
aphasia, mental reading is always affected, that the patient reads but
without comprehending what he reads, and that the sight of a word
does not evoke a corresponding idea in the patient's mind.   As
regards the comprehension of spoken speech, Dejerine tells us also
that the functioning of the auditory images is not absolutely perfect;
that if the examiner speaks a little rapidly to the patients, the latter
often fail to grasp completely or at once the exact sense of what is
said; that the same thing occurs when the sentence spoken is a little
long.   These statements are in keeping with general experience.
Thomas and Roux have likewise shown, by their method of syllabic
analysis, that the auditory interpretation of spoken speech is impaired
in motor aphasics.   Their method is briefly as follows: The patient
being shown an object, there are pronounced before him several
syllables, among which are found, it may be, the first, the last, or the
intermediate syllable of the name of the object.   The first syllable
is quite often recognized by the aphasic, but the last or the inter-
mediate syllables are never recognized.   Failure or impairment of
recognition of spoken words is thus absolutely demonstrated.   Failure
or impairment of recognition of speech, spoken and written, can only
result in failure of speech comprehension.

That in so-called sensory or Wernicke's aphasia we have likewise
an impairment of auditory and visual interpretations goes, of course,
without saying, and it, therefore, results as a matter of simple logic
that Broca's and Wernicke's aphasia have one symptom in common,
namely, an impairment of speech comprehension, and it would
further appear that such differences as may be noted are differences
in degree and not in kind.   From these preliminary considerations,
therefore, it results that the subject which must of necessity first
claim our attention is that of impairment of speech comprehension.

When we pause to consider the nature of speech comprehension
or speech recognition, the theory of verbal images, auditory and
visual, at once suggests itself, and yet no second thought is necessary
to realize how unsatisfactory this theory is.   That it explains nothing,
but only obscures the problem, soon becomes apparent.   Its hopeless
inadequacy and insurmountable difficulties have already been pointed
out by others, and I will not take time to consider them at length.

Suffice it to say that the theory of images means merely that every object seen or heard is in some way duplicated or imaged in the brain, and that these images are stored up in definite centres. If there be images of things heard and seen, there must also be images of impressions received through all of the other senses. Again, to make the application of the theory complete, we must in the case of speech also add motor images—whatever that may mean. Finally, we must suppose that there are special areas in which these images are combined, associated, or otherwise dealt with, in order to make thinking possible. No adequate conception can be formed of such images and such processes, and in truth the theory deals not so much with ideas as with words.

It is perfectly legitimate to attempt another explanation of the function of language, and although such an explanation must of necessity be largely speculative, it will be seen that it is, at least, possible to couch an explanation in physiological terms. Clearly the evolution of speech recognition or speech understanding must have been preceded by the evolution of a sense of simple sound recognition; that is, the first step must have consisted in the formation in the mind of primitive man or of his progenitors of an association of the sounds of nature with the objects or phenomena giving rise to these sounds, just as man has learned to associate the tactual qualities of the objects of nature with the objects themselves. The evolution of the faculty of sound recognition is, in a sense, therefore, analogous to the evolution of the faculty of stereognosis. In stereognosis there is an association of the tactual qualities, in sound recognition an association of acoustic qualities.

In other words, to man's knowledge of the external world, made up of the perception of tactual qualities, there is added, among other things, a knowledge of the external world made up of its qualities of sound. The primitive recognition of natural sounds, that is, the association of the sounds of nature with the phenomena giving rise to them, is a faculty which man doubtless shares with other animals. It must of necessity, in addition, form the basic substratum upon which in him the more complex function of language has been built. Certainly it seems legitimate to assume that language recognition and language comprehension have been evolved from this faculty of the primitive recognition of sounds. In ordinary sound recognition there is the immediate association of the sound with the corresponding object in nature. In the sound recognition of speech there is the recognition of definite sounds associated not directly with objects in nature, but with the conceptions of these objects. The steps by means of which spoken speech was evolved will probably never be known and will forever remain a matter of speculation. It is fair to assume, however—at least, it does no violence to any laws of probability—that the first attempts at spoken speech consisted of efforts on the part of man to reproduce sounds similar to those heard by him

in nature. It would seem that in some such way as this notions and ideas were in the beginning communicated to his fellows, no doubt vaguely and imperfectly at first. Based upon such rudimentary beginnings, a progressive evolution of spoken speech and speech comprehension is readily conceivable.

ASSOCIATION. Having formed this elementary conception of the speech function, and having divested our minds entirely of the theory of speech images, let us turn our attention to disturbances of speech comprehension. In doing so, we must, of course, keep separate the differences obtaining between the failure of simple sound recognition and the failure of speech recognition. Looking upon the term stereognosis as a convenient model, simple sound recognition can properly be termed acougnosis and speech recognition logognosis. Acouagnosis and logoagnosis would mean the loss or impairment of these functions respectively, and would be analogous to stereoagnosis. The study of the speech function is in reality a study of word-sound associations, just as the study of stereognosis is the study of tactual associations. The failure of a word to call to mind the qualities of an object, and to combine these qualities into a conception of the object, must obviously depend upon a failure of association; further, this association involves, as we will see presently, much more than mere sound association. For the present, however, it may be broadly stated that the failure of the recognition of articulate sounds as words or of the meanings of phrases or sentences, is dependent upon a defect of association, that is, a defect in the power of the combination of auditory impressions—of auditory impressions among themselves and also with impressions received through other channels.

That association is involved has, of course, been many times recognized by students of aphasia, but that it is the main or essential feature of aphasia has not been generally held. Approached from this point of view, the study of aphasics becomes exceedingly interesting. The peculiarities presented by the defects of association vary greatly in different cases, both in the degree in which the symptoms are present and to some extent as to the kind of association that is defective. In order to make my meaning clear, I will use as illustration briefly the following case, which belongs to one of the large group of aphasics always at our command for study in the nervous wards of the Philadelphia General Hospital:

W. E., aged thirty-three years, a male, right-handed, was admitted to the Philadelphia General Hospital October 30, 1905. He presents the symptoms of a typical, spastic, right-sided hemiplegia with aphasia. Spontaneous speech is limited to yes and no and to an imperfect pronunciation of his name. Agraphia and alexia are also present. In other words, he presents the clinical picture of a so-called motor or Broca's aphasia. Apparently, he is able to comprehend much of what is said to him, much of what is going on about him, and conducts himself properly in the ward and at the table.

However, when his faculty of comprehending spoken language is tested in detail, as by the method of Marie, it is found that he is able to comprehend simple instructions only, such as, "Place your hand upon your head," "Place the pencil upon the paper;" at most he can carry out consecutively only two such instructions. He also fails to carry out an instruction correctly when it embraces, instead of two objects, three or more. When asked to count, he says, "One, two, three," but is unable to proceed any farther. Although he cannot read, he is asked to copy the written word "boy;" this he is unable to do. The word is then placed before him in large printed characters; he makes a drawing of the letters, but does so very imperfectly. Asked to repeat monosyllabic words, such as boy, girl, cat, man, milk, etc., he is able to say them, but with very imperfect enunciation; there is a marked dysarthria. A number of objects having been placed before him, he is unable to name any of them spontaneously. However, if he is told to point out an object, the name being plainly pronounced by me, such as spoon, knife, fork, cup, pencil, etc., he does so correctly. Now, a given object having been selected, say a tumbler, he is asked, "Is the tumbler rough?" He nods his head in the affirmative and says, "Yes," although the glass is entirely smooth. Asked now whether the tumbler is smooth, he again answers in the affirmative. Questioned a third time whether it is rough, he again answers in the affirmative. An attempt to communicate to him the facts as to this physical quality of the tumbler fails. He is similarly unable to distinguish between such qualifying words as "round" and "square." Errors were made alike if the objects were merely placed before him and if he held them in his hand. It is to be noted that a knowledge of the qualities such as I have mentioned are acquired by the sense of touch, but are normally associated in the mind with the spoken name of the object; they are part of the conception which the spoken name calls forth. Asked, Is the tumbler full of water? He says, "No," which answer is correct. The tumbler being held before him a moment later, he is asked to repeat its name. He now utters the word "water," and when the attempt is made to correct him and he is told that the name is tumbler or glass, he shakes his head in the negative and says, "No."

A number of pieces of colored chalk, blue, white, yellow, and red, were now added to the objects on the table. Asked to pick up the blue chalk and place it on a piece of paper before him, he picked up the yellow chalk. This test was varied and repeated very many times; and the percentage of errors was so large as to lead to the inference that he did not recognize the qualifying words signifying color. It was also noticed that if the instruction at any time embodied three factors, he usually failed in the proper sequence of the things he did; that is, he would become confused and make errors. As far as it was possible to determine, he was not color blind.

He was next tested as to his ability to distinguish prepositions and

phrases indicating relations of space. Thus, a tumbler having been placed in his hand, he was asked to hold the tumbler *above* the table, to hold it *below* the table, to hold it in *front* or to the *side* of the table. Here the percentage of failures was so large as to justify the inference that he did not recognize these words or phrases at all. A similar result was experienced in a test involving the difference between such prepositions as *in* and *on*.

Further, it was easily demonstrated that his recognition of verbs was also very limited. He recognized "put," "is," "hold," "pick up," but he could not make any differentiations of tense. Thus, when he was tested as to "is" and "was," he failed, and in the few instances in which he succeeded his answers were evidently the result of pure guess-work. For instance, a pencil having been laid upon a piece of paper before him, he was asked, "*Is* the pencil upon the paper?" and again, the pencil being removed, "*Was* the pencil upon the paper?" This test, simple in character, was repeated many times; his answers were given "yes" or "no" at random, and there could be no doubt as to his failure to distinguish between these elementary differences of tense.

Tests with other aphasics yielded similar although of necessity varying results, the results being somewhat in proportion to the impairment of the general comprehension, as instanced by the failure of the patient to carry out simple or serial instructions. When the patient was able to carry out complex instructions or a number of serial instructions consecutively, it was usually found that he preserved some knowledge of words and phrases indicating physical qualities, and also relations of time and space; that is, there seemed to be a proportionate recognition of adjectives, prepositions, qualifying phrases, and the ability to make at least simple distinctions of tense. This is well illustrated by the following case:

L. J., aged forty-nine years. Here there is likewise a Broca's aphasia. The loss of motor speech is so complete that the patient cannot say even "yes" or give his name; he says "do" for "no;" when urged to speak, he says "dindo," which seems to be his stock expression.

Question. "What is your name?"
Answer unintelligible.
Q. "Can you say any words at all?"
A. Shakes his head in the negative. Is emotional and weeps.
Q. "Say 'yes.'"
A. Fails.
Q. "Say 'no.'"
A. "Do."
Q. "Say 'all right.'"
A. "Aw aw da."
Q. "Stand up, take your chair, and bring it toward me."
Complies perfectly with the instruction.

Q. "Strike on the floor three times with your cane, then sit down and place your cane on your knee."

Complies perfectly.

Q. "Rise from your chair, take three steps toward me, go back, turn your chair so that it faces the wall, and then sit down."

Complies perfectly.

Three pieces of paper of unequal sizes having been placed on the table, he is asked to take the largest piece, to crumple it and throw it on the floor, to take the smallest piece and hand it to the nurse, and to take the medium-sized piece and to hand it to me. He complies with the instruction except that he not only crumples the piece of paper that he throws on the floor, but also the pieces that he hands to the nurse and myself. When the tests are made still more complex, he invariably fails.

A group of objects having been placed upon the table before him, he correctly indicates the objects as they are named by me. He also recognizes words indicating the physical qualities, such as smooth and rough as applied to a glass, and such physical qualities as color. He also recognizes such words and phrases as indicate space relations, that is, "above," "below," "in front of," "to the side of," etc.

He can recognize his own name when written before him. He recognizes the word "hand" when this is shown to him in either written or printed characters. This is also true of other simple monosyllabic words indicating objects. However, if a sentence is written, such as "Raise your left hand," he cannot construe it and fails to comply with the instruction. In other words, this patient, whose sound recognition of speech has suffered relatively moderately, but who has a very marked loss of motor speech, has associated with this loss of motor speech a very pronounced alexia, an alexia, too, which is especially evident the moment he attempts to combine even a limited number of words into a phrase or sentence. He is also unable to tell the time.

The peculiar inability of the aphasic to combine words into phrases and sentences is shown in a number of ways. Thus, W. E. is able to say after me each of the following words *separately:*

"The," "pencil," "is," "on," "the," "paper." While he is able to pronounce these words with sufficient clearness to be readily understood, he is utterly unable to *combine* them into the sentence "The pencil is on the paper." The most that he can do after repeated urging is to say, imperfectly, "pencil paper."

The following case shows the same thing to be true in the instance of written words:

J. McN., aged fifty-seven years, presents a marked right-sided hemiplegia with contractures and aphasia. His speech is limited to "yes." On rare occasions, when asked, "How are you?" he replies, "All right." He recognizes his spoken name, for he turns around when addressed. Asked whether his name is John, he says, "Yes." Asked

whether it is William, he first shakes his head in the negative, but afterward appears to be confused and in doubt. He is unable to comply with simple instructions, such as, "Raise your left hand." Asked to put out his tongue or to shut his eyes, he fails to comply. He will, however, repeat various gestures made before him in pantomime, but his repetition of the gestures is imperfect; his gestures are, of course, made with the left hand. He feeds himself and appears to recognize such utensils as a spoon and cup, and to use them properly. However, when an open-faced watch is placed in his hand with the face down, he makes no attempt to turn the watch over so that he can see its face. When the face is turned up for him, he looks at the watch, smiles, but gives no sign of recognition. When he is approached from behind and the watch—a loud-ticking one—is held close to his ear, although not touching him, he again fails to give the least sign of recognition. He is not deaf, as is readily demonstrated when his name is pronounced in an ordinary voice, as he immediately turns. He appears to recognize the various articles of his clothing, and assists the nurse when he is being dressed. He has complete agraphia. An attempt to write leads merely to the forming of unintelligible markings upon the paper. He is, however, able to read aloud single words, such as "Ireland," "Lawrence," "Jordan," "leaf," "house," "head," "hand." These words, to our surprise, he pronounces, and although the pronunciation is dysarthric, they can readily be understood. If, however, a simple instruction be written before him, such as, "Put your hand on your head," he fails to comply, just as he does when the instruction is given to him verbally. In other words, he has no power to combine the individual words which he is able to read. He cannot grasp a phrase, either spoken or written, so as to enable him to comply or perform an instruction, no matter how simple.

REËNFORCEMENT. Every one who has studied aphasics has noted that the symptoms presented by an individual case of aphasia not infrequently vary. This fact may be observed at different examinations or may be noted in the progress of one and the same examination. While the degree of variation is usually not great, both the fact of its existence and the character of the change are important as throwing an additional light on the nature of aphasia. The variation may be due to several causes: (1) A patient subjected to an examination, even if not very prolonged, may sooner or later present signs of fatigue, that is, the answers or compliance with tests, at first successful, may, as the examination proceeds, fail; (2) it may be noted in repeated examinations that the patient responds more and more readily; in other words, that the examinations are themselves re-training or reëducating the patient. There is, however, a third cause of variation of symptoms much more interesting and much more important than either of these and the phenomena of which can best be explained by a theory of reënforcement.

Every one is surprised now and then by the emission of words and phrases by the aphasic spontaneously when previous examinations had failed to elicit anything more than perhaps "yes" or "no" or some simple expletives. That such phrases are heard under the stimulation of unusual excitement is well known. For instance, one of my patients, whose single utterance is "yes," when I insisted upon his saying the word "no," failed as at previous examinations. Finally, upon my insisting repeatedly and emphatically, his face flushed and he suddenly shouted, "I can't say no," at the same time shaking his head. While I have studied this man a great many times, this is the only sentence that I have ever heard him utter. It is fair to assume that in this instance the general cerebral activity had been forcibly aroused or stimulated, and that this had had the effect of reënforcing the impaired speech function; that is, inhibition had been momentarily overcome by a powerful reënforcing wave.

The curious instance of the singing aphasics can only be met by a similar explanation. For instance, I had under my care some years ago a Broca aphasic, whose speech was limited to "yes," "no," and a few brief expletives. He could, however, sing—among other things—Auld Lang Syne, carrying the air well and enunciating each word clearly. No other explanation, it would seem to me, than that of reënforcement overcoming inhibition can apply in such a case.

Reënforcement in aphasia can be illustrated in a number of other ways. For instance, one of my aphasics who at one examination was able to count as far as three, at a subsequent examination, after he had been stimulated by a number of tests, counted as far as sixteen. Here, again, we have doubtless to apply a principle of reënforcement. Again, another of my aphasics counts as far as twenty. He does so apparently without effort, but becomes confused when twenty or twenty-one is reached. Further, he enunciates the names of the various numbers quite correctly during the act of counting. If, now, I allow a moment or two to elapse, and then ask him to repeat after me one of the intermediate numbers, say thirteen, *separately*, he fails. He makes a sound, it is true, but it is quite unintelligible. Tested with other separate numbers, the result is the same. It would appear that in this case the uttering of the number in serial sequence is, after the start is made, largely a matter of reënforcement. Counting is taught in childhood in such a way that a serial association is early formed in the mind—a serial association basic and strong. In our patient, the count having been started, each number evokes its neighbor in the series; each reënforces the one that follows and necessarily along a pathway of time-worn association. Taken out of its sequence, a number is either not enunciated at all or the enuciation is dysarthric. In our patient it requires the reënforcement resulting from the formation of the previous numbers to make the emission of the given number possible.

The existence of more complex associations and reënforcements can be illustrated in still other ways.

C. A., aged fifty-six years, who early in May, 1908, suffered from a paralysis of the entire right side, can answer "yes" and "no," give his name imperfectly, and can utter a limited number of other words. His enunciation is markedly dysarthric.   His name is Christopher A.

Q. "What is your name?"

A. "Christian."

Q. "Is your name not Christopher?"

A. "Yes, Christopher."

Q. "Have you no other name?"

A. "No." (After an interval) "Almus" (incorrect).

Repeated efforts to have him pronounce his name in full and correctly fail.

Q. "What is your age?"

A. "Thirty-eight." (As already noted, his age is fifty-six.)

Q. "What is your business?"

A. After a long delay he answers "Carpenter."

Q. "Where did you work last?"

Answer unintelligible.

Q. "Are you comfortable?"

A. "Yes."

Q. "Do you want anything?"

A. "No."

Q. "How long have you been in the hospital?"

A. "Couldn't tell."

Q. "Can you count on your fingers?"

A. "Yes."

Q. "Count your age on your fingers."

A. Now counts aloud as far as 29, jumps to 40, and then goes back to 21.

He is unable to say the word pencil, although he recognizes the pencil and correctly points at it.   When, however, he takes hold of the pencil, handling it correctly, he says, "pencil."   The same thing is noted in the case of a key ring.   He looks at it, is unable to say the word, but after handling the object for a time says "ring."   It would seem as though we have here to do with both stereognostic and visual reënforcement.   The visual recognition and naming, by an aphasic, of an object is in a sense the result of a visual reënforcement, and in a similar sense this must be true of its tactual recognition.   When the words pencil, keys, and ring are said before him, he correctly points out the objects.   Other tests were made with this patient with regard to reënforcement by taste and smell.   Although not very successful, they were very suggestive.   In the case of syrup, for instance, which was poured out before him, but which he would not or could not name, he at once called "molasses" as soon as he tasted it.   In a test made with vinegar, concerning which he would say nothing from

merely looking at it or smelling it, he finally called "cider" when he tasted it. He is unable to read even his own name in either printed or written characters. He cannot write or copy. When urged to write, he makes with his left hand the letter "C" backward, as in mirror writing. Asked to write twenty, he puts down 01. He will repeat imperfectly a few simple words, but he cannot combine them into sentences. Once only he repeated after me the sentence, "I am well."

In this instance there appeared to be an unmistakable reënforcement of the word-forming power or of word emission by the perception of tactual qualities in two instances, and by the perception of those of taste in a third. Responses were also at times obtained by urging and insisting upon an answer, although here readiness of fatigue interfered with the results.

The following case, which presents a marked loss of speech comprehension, but no impairment of emissive speech, is interesting because of the failure of both tactual and visual reënforcement to enable the patient to name objects. It is not improbable that the failure was related to the intensity of the loss of speech comprehension.

M. J. O'B., aged forty years, had been admitted to the nervous wards of the Philadelphia General Hospital, with an unsatisfactory history of an injury to the back of the head some months before and the subsequent development of convulsive attacks and "loss of memory." When questioned, a difficulty of speech comprehension at once becomes apparent, although no difficulty of emissive speech, no difficulty of enunciation, no anarthria, can be detected.

Briefly tested at first by a series of instructions, according to the method of Marie, it is found that he frequently fails to carry out simple instructions, such as picking up an object from the table. He invariably fails when the instructions embody two consecutive acts. Thus, asked to pick up a piece of paper from the table, he may comply, but if asked to pick up the paper and throw it into the waste basket, to crumple it in his hand, or to mark it with a pencil, he invariably fails. The same result ensues if the number of the objects with which he has to deal is increased. Among other things, he was questioned as follows:

Q. "What is your name?"

A. Answers correctly.

Q. "Where were you born?"

Looks about him for some time, and finally answers, "Thirty."

When the question is repeated in different ways, he finally answers, "Don't understand."

When the question is now modified, "Were you born in America or Ireland?" he answers, "I was born in Camden."

Q. "Why can you answer as to your place of birth at one time and not at another?"

A. "Sometimes I can and sometimes I can't."

Q. "Are your father and mother living?"

A. "My mother is, my father dead."

Q. "Where was your father born?"

The patient again assumes a look as though he did not comprehend, points back of himself, and finally says, "You can say, I can't."

When the word Ireland is suggested, he nods his head in the affirmative. He is then able to repeat the word Ireland immediately after it has been said before him, and the enunciation is clear and distinct.

Q. "What is your business?"

A. "Buy barrels."

Q. "What do you do with them?"

A. "Work for my brother."

Q. "What did you do with them?"

A. "Sold them."

Q. "Have you any relatives?"

A. "Yes."

Q. "Who are they?"

A. "A man."

Q. "What is he?"

A. "He makes those." (Rises and points to the spigot of the water cooler.)

Q. "What is this man to you?"

A. Again points to the spigot of the water cooler.

Q. "Is he your father?"

A. "Yes."

Q. "Your father is dead. Is he your brother?"

A. "Yes, brother."

He then himself asks the question, "Do you mean Frank?" and then answers the question himself, saying "Yes, brother."

Q. "Are you sitting or standing at present?"

A. No answer.

Q. "Am I sitting or standing at present?"

A. "Yes sir."

Q. "What day is this?"

A. "Thursday" (correct).

Q. "Is it day or night?"

A. "Day."

Q. "Is it morning or afternoon?"

A. "Morning" (correct).

Q. "What is this?" (indicating a chair).

A. "I know, but can't say."

He is now asked to touch it, to lift it, and to sit upon it, but is still unable to give the name.

Q. Asked again, "What is it?"

A. "I can't say."

Q. "What is it for?"

A. "To sit on."

Q. "Point to a table in this room." (The room contains two tables and a desk.)

A. "There isn't any."

Q. "Is there a desk?"

Points correctly at the desk.

Q. "Is this a table?" (indicating a chair).

A. "No."

Q. "Is it a desk?"

A. "No." (Patient again points to the desk.)

Q. "Is it a broom?"

A. "No."

Q. "What is a broom for?"

A. "Anything that is dirty."

Q. "Is this a chair?" (chair indicated).

A. "No."

Q. "What is this?" (indicating a knife).

A. "Can't say."

Q. "What is it for?"

A. "To cut with."

Q. When the knife is placed in his hand, he is equally unable to name it.

Q. "Is it a spoon?"

A. "Can't say."

Q. "What is this?" (handing him a watch). He looks at it, feels it, and places it to his ear, but cannot say what it is. Finally, he says, "I know what it is, but can't say it."

He can repeat readily the names of objects when they are laid before him, but his ability to call the names to mind spontaneously is greatly impaired. When the word "pencil" is placed before him in printed characters, he replies, "Cannot say it." Asked then to point out the object for which the printed word stands, he fails to do so, though there are several pencils on the table.

He correctly indicates, as already stated, his hand, his head, indicates correctly a chair, but fails to indicate a clock, although a large clock is almost directly in front of him. He is able to write his name, but cannot write sentences spontaneously or write at dictation. He copies by drawing the letters imperfectly of words placed before him.

He can read monosyllabic words, such as hand and head, when these are in large written or printed characters. He fails, however, to understand this written sentence: "Put your hand on your head." Cannot construe the sentence and fails to comply with the instruction. When he is told verbally to raise his hand and place it upon his head, he complies, but only after much delay and after repetition of the instruction. He fails in very simple problems of arithmetic, although he forms the figures very well.

In this case, which would, of course, be included in the classical division of the sensory aphasias and in which anomia would be considered as the leading feature, we have of special interest: (1) The occasional breaking through of answers or even spontaneous statements when avenues of reënforcement are opened up by the excitement and stimulation of the examination. (2) Contrary to what we observed in the case C. A., we note failure of tactual reënforcement to bring about the formation and emission of the name when the visual reënforcement fails, and (3) the very marked inability to execute serial instructions. Both of the latter features are doubtless related directly to the degree of the impairment of the speech comprehension.

We are justified from clinical evidence alone in the inference that the area of the cortex concerned in speech recognition is normally in close relation with other areas concerned in the recognition of the physical qualities of the external world. That this relation is intimate in the case of the visual and tactual functions goes without saying; that it also exists in the functions of taste and smell seems equally incontrovertible. The loss of the ability to associate properly, for instance, articulate sounds with tactual qualities, must lie in a break, structural or functional, in the relations between Wernicke's region, on the one hand, and the region of tactual recognition or stereognosis on the other. The same must be true in the case of visual recognition and of recognition by the other senses. It would appear from these considerations that the function of speech comprehension must be very general in its character, one in which very extensive regions of the brain are concerned; and this fact must be borne in mind in estimating the effects of a limited lesion. Here the dangers and difficulties of interpretation are great. The symptoms present may in part owe their existence to disturbances in the relations between the area involved and quite distant regions of the brain.

The phenomena of reënforcement seem to prove that some, at least, of these disturbances of relation are functional; if the break were always structural, reënforcement could at no time occur. Many of the symptoms, therefore, noted in aphasics must be due to inhibition, and the theory of the diaschisis advanced by von Monakow shows very clearly how this change or splitting off of function, or, better still, *suspension* of function, may occur. On no other basis than that of the overcoming of inhibition are we able to explain the various phenomena of reënforcement. In order that reënforcement may occur, a pathway cannot be altogether closed, but need be only so much influenced by a lesion as to impede or suspend for the time being association. Clearly it is association which forms the chief problem in the study of aphasia.

EMISSIVE SPEECH. In some of the illustrations I have used, reënforcement has of necessity been considered in relation to emissive or spoken speech. When we turn our attention to this faculty, we find that clinical studies reveal additional facts of exceeding

interest. For comparison I selected: (1) A typical case of pseudo-
bulbar palsy; (2) a case which appeared at first sight to be a pure
motor or subcortical aphasia; and (3) a typical case of Broca's
aphasia. The views of Marie in regard to anarthria urgently sug-
gested such a comparison.

In outline the case of pseudobulbar palsy is briefly as follows:

T. R., aged thirty-five years, suffered a year before his admission
to the Philadelphia Hospital from an apoplectiform seizure, which
left him with a mild left hemiplegia, from which he rapidly recovered.
Three months later he had a second stroke, this time affecting the
right side, but also transient in character. After the second stroke
it was noticed that his speech was very indistinct. His general con-
dition improved decidedly, but the difficulty in the speech persisted.

When admitted, it was noted that his gait is somewhat shuffling,
his legs slightly spastic. The knee-jerks are increased and there are
an ankle clonus and Babinski reaction on the left side. The patient
is unable to extend his lips or to protrude his tongue beyond the lips.
He usually holds his mouth open; has difficulty in holding liquids in
his mouth and in swallowing; cannot close the mouth firmly; cannot
whistle. The tongue presents no atrophy, but the patient's power to
direct it upward, downward, or to either side is greatly impaired.
Examination of the larynx fails to reveal positive findings; at one
time an abductor weakness, at another an adductor weakness,
appears to be present.

It is important also to record that the patient is constantly either
smiling or laughing; automatic laughter is a marked feature of his
case. To some extent this laughter is reflected in the general tone of
the patient, who in reply to questions says that he is happy and not
depressed.

When his speech is investigated, it is found that he is able imper-
fectly to form vowels and still more imperfectly consonants; indeed,
the ability to form consonants is so feeble that it can hardly be said
to exist. Repeated examinations, however, have made me more or
less familiar with his peculiarities, and I am able to interpret much
of what he says or tries to say, imperfect as this is.

Of course, there is here no question of aphasia, properly speaking,
no failure of speech comprehension. He understands everything
that is said to him, he reads, writes, and tells time correctly. He
carries out verbal serial instructions correctly as long as these embody
only three factors. If they embody four factors, he fails. If the
serial instructions are written instead of verbal, he again complies
correctly; he again fails, however, when the number of factors is
four, unless he stops in course repeatedly to read his instructions. It
is also noted that while he is able to do simple sums in arithmetic, he
fails as soon as the additions or subtractions become at all compli-
cated. At one time, also, as do aphasics so frequently, he began an
addition at the left hand column; possibly embarrassment and con-

fusion played some role in this gross error, which he did not himself perceive; the test was made at the blackboard, and in the presence of a class of students. However, his marked arithmetical incompetence is rather remarkable, inasmuch as he was by profession a draughts-man, and, if he is to be believed, well educated. The question arises, of course, whether in lesions so gross as those of pseudobulbar palsy there is not necessarily some general mental impairment. The fact, however, whatever its explanation, is exceedingly interesting. It becomes especially so when we turn our attention to the next case, the one which, at first sight, seems to be one of pure or subcortical motor aphasia.

R. J., aged sixty-three years, male, right-handed, suffered six weeks before admission to the hospital with a right-sided hemiplegia. This hemiplegia was slight and of short duration. At the time of his admission to the hospital his physical examination was negative, save that the grip of the right hand was not quite as good as the left, and that there was some flattening of the right lower face. He could not retract the right angle of the mouth as well as the left. He could not whistle. He could protrude the tongue well and move it in all directions. He suffered, however, from a marked impairment of speech, and was at once classified as a "motor aphasic."

Examined in detail, it is found that he presents a high degree of anarthria. This is so great as strikingly to resemble the anarthria of the pseudobulbar case just cited. He gives his name as Josup Josun, which is intended for Robert Johnson; pronounces "yes" at times correctly, at times as "gess," and "no" frequently as "do." Enun-ciation is very indistinct and difficult to follow; often final syllables are not pronounced at all. He counts aloud, but with marked dysarthria: bon (1), tno (2), tee (3), our (4), fiz (5), chick (6), cheven (7), eat (8), etc. He recognizes objects and, making allowance for his high degree of anarthria, names them correctly. He can repeat after me short sentences, but with, of course, marked anarthria. When the sentence contains two phrases, the repetition is very incomplete. When the sentence contains three phrases, each embodying a separate idea, he always fails; what he says becomes completely unintelligible.

The patient is on duty as cook for the night watchmen; the head nurse states that in the mornings he asks for his supplies in one word, or in separate words, never in phrases or sentences. Frequently, instead of attempting to communicate his wants by word of mouth, he will write them; e. g., "Kindly give me some sugar. Dining-room men used mine." Again, "The men in the dining room stopped me taking potatoes for the night men. They grumble when they don't get potatoes. They cook them for supper and breakfast." It should be added that he discharges his duties as cook well. He can also write at dictation simple words. In writing sentences, he usually begins properly, but soon makes mistakes. Tested verbally as to carrying out serial instructions, he complies promptly and readily.

In this respect he does not differ in the least from the pseudobulbar case just cited. If, however—and this is the important point in his case next to the anarthria—if he be handed a series of *written* instructions, he carries them out imperfectly, and even with the written instructions in his hand he sometimes fails altogether. In other words, he betrays an alexia—an alexia which consists in the inability to *comprehend* properly the written instructions. When he attempts to read aloud, only a few words here and there can be understood.

Here, then, is a case the anarthria of which closely resembles that of pseudobulbar palsy, and which is, notwithstanding, associated with an alexia present in a degree; but for this symptom the case would fit exactly into the group of subcortical or pure motor aphasias. Does he not, however, even in this respect resemble the case of pseudobulbar palsy just cited? For, in the latter, let us recall there was also a distinct difficulty in the interpretation of written instructions. The case of R. J. suggests to our minds the query, Does *pure* motor aphasia really exist in nature? Personally, I have never met with it; is it not always pseudobulbar palsy?

The patient suffering from pseudobulbar palsy, we will recall, was constantly laughing; indeed, he presents a typical instance of the automatic laughter not infrequently met with in pseudobulbar palsy. In our third patient we have an instance of a motor aphasic who, like the pseudobulbar case, is constantly laughing. Briefly, W. W., aged fifty-seven years, right-handed, right-sided hemiplegic, has a pronounced anarthria, his speech being limited to "yes" and "do" (for "no"); he understands much that is said to him, executing serial instructions fairly well; he suffers, however, from a pronounced alexia. While he is able to read an occasional isolated word, he fails utterly to construe a sentence and fails, therefore, in executing written instructions. Other than this, he presents no peculiarities save that he laughs, laughs automatically, laughs just as much as does the patient with pseudobulbar palsy. I have occasionally met aphasics who laughed readily, laughed a great deal, but I have never met one who laughs quite as much as W. W. On the other hand, as is well known, there are aphasics who weep readily—who are readily provoked to weeping during an examination. Of course, it may be claimed that laughter and weeping in pseudobulbar palsy and laughter and weeping in aphasia are merely analogous facts and bear no clinical or pathological relations to each other. To me, however, the facts are most suggestive, both clinically and pathologically, especially when we take into consideration, on the one hand, the known involvement of the lenticula in pseudobulbar palsy, and the involvement of the lenticula as claimed in the anarthria of Marie and found to exist among others in one of my own (published) cases. The pathology of automatic laughter and weeping is, of course, not known, that is, if it have a pathology apart from that of pseudobulbar

palsy; that we meet with it at times in Broca's aphasia is not surprising if some relation between the two affections be admitted.

It might be claimed that our case of pseudobulbar palsy is in reality a case of aphasia; that this is shown by the fact that the first stroke, which was left-sided, was not followed by the speech disturbance, but that the latter ensued only upon the second or right-sided stroke. However, the fact that both strokes were slight and transient in character, as they so often are in pseudobulbar palsy, so as to leave little subsequent physical evidence, and the further fact that the patient presents distinct weakness of the lips, that he is unable to hold liquids in his mouth, has difficulty in swallowing, cannot close his mouth firmly, cannot whistle, and, although the tongue presents no atrophy, that he cannot protrude it beyond the lips and cannot move it well up or down or to either side, prove conclusively that the case is one of pseudobulbar palsy and not aphasia, and yet some of the clinical findings are, as already pointed out, suggestive of aphasia.

THE SIGNIFICANCE OF ALEXIA. To my knowledge no attempt has ever been made adequately to explain the intimate association of the loss of motor speech and alexia. It is in my experience a striking fact that in by far the larger number of cases of Broca's aphasia the loss of the power to read exceeds—and usually decidedly—the loss of the power to comprehend spoken speech. If the loss of motor speech depends upon lesion of the third frontal convolution, why this remarkable association with alexia? Is it not a more reasonable explanation to assume that the lesion, whatever its situation, is one which interferes with speech comprehension—the one symptom common to all aphasics—and that the form of speech comprehension which of necessity suffers most is the comprehension of *written* speech? Comprehension of spoken speech is a faculty as old as the race, comprehension of written speech at most an acquisition of a few generations. Which faculty would we expect, therefore, to suffer most? Is it not natural that the infinitely older and basic faculty of the comprehension of spoken speech should frequently suffer less, or even little, while the power to comprehend written speech is literally swept away?

It is quite evident that in the study of aphasia general conceptions of cerebral function must ever be kept in mind, lest special reasoning lead us too far astray. It is for this reason that general procedures, such as the serial instructions of Marie, often prove so valuable. The serial instructions are a test, (1) of the general faculty of speech comprehension; (2) of the presence of apractic elements; (3) of the general intellectual integrity. Apraxia, when present in aphasia, means necessarily a lesion of great extent or a lesion involving widely diffused associations. General intellectual impairment, of course, argues for a still more extensive diffusion of the morbid condition.

The application of the theory of the diaschisis of von Monakow enables us to explain many of the vagaries of the lesions of aphasia.

How greatly the lesions vary, both in location and size, is well known; this is especially apparent in the revisions of von Monakow and of Moutier. In a measure the theory of the diaschisis enables us to reconcile these variations, and it also enables us to explain the suspension of function with subsequent recovery. It cannot, however, enable us to upbuild a function once destroyed. Thus, given a lesion of the third frontal convolution, with loss of the emissive speech function and subsequent recovery of this function, diaschisis cannot be invoked to explain the recovery of that function *as the function of the part destroyed*, namely, of the third frontal convolution. To maintain that the neighboring cortical areas have assumed the function, or that the function has been restored because the individual happened to be ambidextrous, is virtually begging the question. The obvious objections to such explanations have already been pointed out by others. However, whether the third frontal is or is not concerned in aphasia is really not an important matter. If it is, the clinical and pathological evidence should be forthcoming. All will agree, I think, that this evidence is at the present day most meagre. It is certainly significant that permanent speech disturbances do not follow lesions limited to the third frontal convolution. It is quite safe to assert that thus far not a single unequivocal case, a case free from criticism, has appeared in the literature. As Marie has pointed out, and later Pick and von Monakow, permanent disturbances of speech associated with lesion of the third frontal convolution are only present in cases in which the lesion is deeply penetrating and extensive in its distribution. Negative cases, that is, non-involvement of the third frontal convolution, on the other hand, are not at all infrequent. I have myself only recently acquired two such specimens; a third I placed on record a few years ago.

In the foregoing paragraphs I have purposely refrained from the use of terms implying special theories, such as word blindness, word deafness, transcortical, subcortical, or conduction aphasia, or paraphasia. I have thought it wiser to lay stress upon general facts such as in my judgment lend clearness to our conceptions of the speech function and react indirectly upon our conceptions of cerebral activities in general.

SCHOOL LIFE AND ITS RELATION TO THE CHILD'S DEVELOPMENT.[1]

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I suppose it is generally known that a great wave of interest has been passing over this country during the last two or three years. This wave is a movement in favor of so changing the laws of the different States that the early life of human beings should be more protected than it now is under the State laws which govern matters pertaining to child labor. A great deal of discussion has also been carried on regarding the local government of the public schools. The object, in both instances, has been to investigate whether the laws which have existed for many years are the best that can be made, and whether we, in grading our public schools, are really carrying out ideas which from a modern point of view are considered best. There is no doubt, in regard to the former proposition, that the laws governing child labor are not only fundamentally wrong from their lack of wisdom, but that even if they were right, they are so constituted that they cannot be properly enforced.

While carrying on some scientific work in connection with the development of early life, by means of the Röntgen-rays, I arrived at certain conclusions which proved to me that those who are in charge of the welfare of children are ignorant, in many ways, regarding certain facts connected with the physical condition of children. As a corollary to this, it was easy to show that many of the rules made in the past for the good of children, are with our present knowledge manifestly far from beneficial, and, in fact, are founded on ignorance of the latest scientific modern investigations. Ignorance in itself is not a crime, but when we who, as developed adults, are supposed to protect by our knowledge an earlier stage of development which is manifestly unfit to judge for and care for itself, ignorance becomes a crime if we wilfully do not make ourselves cognizant of what science is teaching us. I shall, therefore, try to point out some plain truths, such as, from a medical point of view, have come to my notice in connection with the rearing of young children, the fitting of these children to become good citizens in the future, and their being prepared, both physically and mentally, to judge of and adjudicate the great questions which must come before them in matters of legislation for their country. An educated mind without a sound body is as unfitted

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[1] The Sunday Free Lecture, delivered at the Harvard Medical School, Boston, March 14, 1909.

to deal vigorously and wisely with the questions of the day, as is a good foot for walking when imprisoned in a tight boot.

Physical suffering perverts good judgment wherever it appears and whenever it is allowed to continue. It is manifestly the case at present that the young of our country are not protected by certain laws and certain rules, which are supposed to protect them during the formative period of their lives, when proper and wise protection means prevention from possible future and lasting injury to both brain and body. I shall not, here, present the reasons why I am so firmly impressed that the various laws and investigations in connection with child labor have been founded on a wrong basis, although carried on by those who are enthusiastically honest in the reforms which they are endeavoring to make. I shall merely state that the results of my investigations point toward the fundamental principle that a child's physical life should be the first factor in the problem of arranging and moulding this life which we as adults have to solve.

The question, therefore, immediately comes up as to whether there is any known means by which we can readily determine, in a large number of cases and in a limited time, what the child's physical condition as represented by its development really is. We know that we cannot judge of these conditions by height, or by weight, or by the eruption of the teeth. All these sources of evidence which for so many years we have considered to be reliable as indices to aid us in our work have one by one proved to be falacious. The tall, undeveloped child, the heavy child with weak underlying muscles and bones, and the frequent variations as the result of modern life and parentage which occur in the appearance of the teeth, are not manifestations on which we can build up a system for grading children. A much more accurate system is needed to determine when they shall be allowed to undertake certain degrees of manual labor and certain strains in athletic sports, and to give out the mental energy required for the different grades of study during their school life. It is this latter class of cases to which I wish to direct attention.

The guide to the grading of children in school, from time immemorial, has been based in great measure on the number of years since they were born; that is, chronologic age has held a position in, and has exercised an influence over, child life for so many years that it has become one of the traditions of the past, and traditions, as you well know, are difficult to set aside. My investigations with the Röntgen-rays show very conclusively that because a number of children are born in the same year it does not follow that these children, as years go on, have developed equally; on the contrary, after a few years some may be far ahead of the development of the average, and some below that average. We also know that the question of development which indicates strength and the power

of resistance to external influences is so closely connected with a child's mental and physical condition that we can no longer, with our present knowledge, keep this element in the background.   If twenty boys, or twenty girls, all of whom were ten years old chronologically were pitted ten against ten, whether in football or in basket ball, a very evident discrepancy in strength, resisting power, and in endurance would become at once manifest.   This difference in the individual development of these children can easily be made manifest by a Röntgen picture of the underlying framework of their bodies, which represents the basis on which their individual strength should be judged.   Quite a number of these twenty children can, in this way, be shown to be perhaps a year or a year and a half in advance of what they would average when judged by their equal chronologic age; some of them would be found to be a year or a year and a half below this standard average of development.   In this case, therefore, we should likely have ten of the children whose development is only that of the average chronologic age of eight and a half pitted against ten who had the average of ten and a half years of age.   It is through these discrepancies that this subject has been brought to my notice most vividly, when I have seen, as often happens, children with an insufficient anatomical development brought to consult me for anemic and weakened conditions often verging on nervous prostration, which conditions have been evidently produced by the endeavor to keep these children abreast, in both school and athletics, of children of an equal age.

In the rearing of our children, therefore, we should not be influenced entirely by their chronologic age, but should study their individual development, and grade them in divisions of perhaps A, B, C, D.   In this way we shall prevent a child, in its daily life, from having its tissues, whether of brain or body, overwhelmed by unnecessarily advanced surroundings.

A possible index by which we can intelligently determine what the surroundings of a special child shall be, can, so far as my studies have carried me, be learned from an investigation of the changes in the development of the joints from birth to adolescence.   In one or two seconds, without the slightest danger to the child, a Röntgen picture can be taken of an especial joint.

In the course of my investigations of some hundreds of cases, in which I have studied the joints in normally developed children, it has been shown that it is not necessary, in most cases, to take a picture of all the joints.   It has also been shown that in healthy individuals, during the formative period of early life, the bones of the wrist in a very large number of cases are so comparatively uniform in their development in comparision with the other joints, that they can be taken as an index of the development of the special child.   It is of great significance that this anatomical index will be

of marked value in the determination of the questions connected with child labor if we remember how children, so far as labor is concerned, are graded, mainly on a chronologic basis. The law may say that a child shall not enter a mill until it is twelve years old. The parents wish to have that child, for pecuniary reasons, enter a mill; they therefore swear falsely to the child's age. The child, again, may be tall for its age, and, although it is only eleven years old, may look as if it were twelve. Large numbers of false birth certificates also exist in this country, so that a chronologic law can easily be avoided. This is proved by the number of children who, though manifestly unfitted for the work which is given to them in the mills, are found in the mills and are honestly supposed to be within the requirements of the law, although they not only may not really be of the chronologic age required by the law, but even if they are of that age, may not be in any way fitted to perform the work allotted to them.

This same reason can be applied to the grading of children in the schools. Their age, in most cases, at least, is honestly given, but it is readily seen that if they are graded chronologically, the same conditions, both physically and mentally, which are good and proper for some of these children, are manifestly bad for others. This same reasoning holds good in regard to the question of kindergarten. Much more definite decisions should be made on the time when an individual child should begin with its kindergarten, or should be advanced to the school grades, than is now the case. It is an argument based on false conclusions to say that a bright and precocious child should be advanced in its school grade until it meets with brains which are capable of safely undertaking mental study beyond that met with in the grade of the chronologically younger children, where the bright child is at first classed. These older brains, being more developed, are not harmed by the physical demands which become strains to the bright brain of the younger child. Precocious children should, from this reasoning, not be advanced to a grade in the school which represents a higher type of physical development, but should be employed in mastering the numerous school occupations of the present day which can be acquired out of doors in connection with physical exercises. These bright brains should not be allowed to be advanced to a school grade of higher physical development until their physical development corresponds to their mental power.

This rule of making the development of a child correspond to its mental condition works in both ways. If a child has a bright, in one sense precocious brain, beyond its chronologic age, but at the same time has an anatomical development corresponding to the development of its brain, it can then be advanced into a higher grade chronologically without harm.

There is no doubt that the principle of grading children by divisions of development determined by some anatomical index, which can be obtained by means of the Röntgen rays, will be the grading of the future. We should consider, also, that the question of exactness plays a very important role when we are determining what this developmental index should be. The Röntgen-rays in their picture tell the truth, and by means of this truth we have a powerful weapon with which we can oppose the deliberate falsehoods of parents, guardians, officials, and of those who, for commercial reasons and through excessive greed, wish to obtain labor at the low cost at which it can be bought when children are employed.

Of equal importance with the labor problem, in its direct baneful influence on the child's life, is the unwise and almost criminal desire of parents, guardians, and school teachers, to advance the child in school as fast as its brain, as a piece of machinery for acquiring knowledge, will allow, without considering that any piece of machinery, no matter how good, may be overstrained and rendered unfit for use when its function is pressed beyond what it is intended to carry. Overtaxed physical conditions may result in weakened brain power. A bright brain is not necessarily strong in its functions. Overtaxed mental capacity may result in physical weakness. It is, therefore, only a common sense view of the subject, and one which I hope every one will try to understand and try to carry out in his or her children's lives, namely, to insist that the grading of children in school shall be based upon an equality of physical and cerebral strength. This simply means equality in development. This, again, simply means a determination by means of an anatomical index of what the special development is. This, however, does not mean that a highly developed physical condition, with a corresponding mental condition, should interfere with the line of action which I have just laid down. The dull brains with a highly developed physical condition can be left to take care of themselves. The brain in this case is taking its rest, will not exert itself, and will rarely be harmed. These children can be allowed to fall back in their classes no matter what their physical development is, and educators can place them where they wish.

A great deal of harm comes to children through their parents and guardians supposing that, because their neighbors' children are allowed to take up, according to their chronologic age, certain traditional or modern amusements or studies, according to the community in which they live, their children also are equal to standing the same more or less necessary strain. For some children the continual round of dancing school, music lessons, children's theaters, and other outcomes of civilization involving exaggerated physical and mental activities, are clearly pernicious, unless under very careful supervision, a supervision which should be adapted to the needs and capabilities of the especial child.

Fig. 1.—The wrist of a girl, aged six months, in which only two small bones are seen to have appeared in the cartilage of the wrist.

Fig. 2.—The wrist of a girl, aged two and three-fourths years, in which there are three carpal bones—thus representing a higher degree of development than is seen in Fig. 1.

To those who have conscientiously studied children, not merely in their diseases, but as they are seen in their homes, in their nurseries, in their play, and in the many phases of the routine of the various out-of-school occupations, in fact, in all the many means of wear and tear which are brought to bear on the modern child, it is an easy matter rightly to understand the bad results which are so often attributed to the school, and often attributed unfairly. It is the combination of all which is required of children out of school, as well as in school, which brings about the last drop in the bucket. If we could begin all over again, and grade our children on the basis of an equal mental and physical development, half of the disturbances of early life which come under the notice of the physician would cease to be in evidence.

FIG. 3.—The wrist of a girl, also aged two and three-fourths years, showing with its four carpal bones a still higher degree of development than does Fig. 2.

The tendency of what our educators call the most advanced education is to harm the well-being of individuals who must eventually become citizens and govern other human beings. Numerous instances can be quoted as to how misguided are the ideas of certain educators, even though they be prominent as educators. We can hardly believe that a body of so-called educators, meeting together to arrange their schedule for the teaching of children through graded years, should gravely debate among themselves what studies each of them would prefer to teach in such and such a year, rather than at what stage of development, both in mind and

in body, it is best for the child to begin such studies; yet this has lately happened.

The parents are often much more at fault than are the teachers. The parents, as a rule, wish to see their children advanced as rapidly as possible, and this phenomenon, which may be called greed of mind, corresponds to what in child labor we have called greed for money.   The school teachers over and over again protest against the child's being forced to do work beyond its physical capacity,

FIG. 4.—The wrist of a girl, aged three and a half years, with an even greater degree of development, as represented by five carpal bones.

but rarely can induce the parents to take a more common sense point of view until the child's physician tells them that if this principle is carried out much longer the child may become a cripple for life.

It is very evident, from what I have said, that the school life of a child has a very strong and important influence in relation to its development.   I ask, therefore, those who are interested in the welfare of children to prevent this unjustifiable grading

of children in their school life. Overtaxing the functions of the brain will result in mental fatigue, and this, in its turn, will affect the entire nervous organization of the child and retard its physical development. This lowering of a child's nervous force and interfering with its physical development renders the child more vulnerable to disease. so that in order to reduce the high mortality which

FIG. 5.—The development and massing of the bones of the wrist in a girl, aged eight and one-fourth years.

occurs in children, we should see to it that by dealing with this developmental idea the child's power of resistance is increased, and, becoming in this way less vulnerable to disease, it will not only have its life preserved where otherwise it might be lost, but in its future life will enjoy a vigorous and healthful existence.

The remedy for the evils which at present surround the school

life of young human beings is that the professed educators, the
school teachers, the parents, the guardians, and those physicians
who have devoted themselves to the study of early life should
act in accord, each giving to the other the especial ideas which
have come from the results of their experience and from the study
in certain lines in which they have become proficient.   As a pre-
requisite, however, for all changes which will in the future be brought
to bear in connection with early life, it should be recognized that

FIG. 6.—The greatly advanced development in number, size, and massing of the bones
of the wrist in a boy, aged thirteen and one-half years.

chronologic age should be done away with as a basis on which to
grade children in schools, in sports, and in the various degrees of
work in which they are employed.   In fact, chronologic age should
be retained only for matters pertaining to the legal profession and in
questions of inheritance.

In order that one may understand what I mean by an anatomical
index, I append pictures (Figs. 1 to 6), which, in their progression
from cartilage to bone, represent different degrees of strength,

owing to the greater strength of bone over cartilage. Starting from an almost entire lack of bone in the first year of life, one will notice that these bones increase in number and in size until finally the almost fully developed wrist is attained at about the age of fourteen to fifteen years. This assumes that the quality of the bone tissue is also normal. This also necessitates a qualitative study in the future of bone tissue as well as bone size.

It is thus seen that there is a complete series of stages of development of the wrist from infancy to adolescence, showing in this way different stages of qualitative and quantitative strength, each of which should be equal to the endurance called for by certain kinds of mental fatigue as well as manual labor.

COMPRESSION OF THE PULMONARY VEINS, THE PRESSURE FACTOR IN THE ETIOLOGY OF CARDIAC HYDROTHORAX.[1]

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THE hydrothorax that sometimes accompanies heart disease has been recognized for many years. Why it occurs in some cases and not in others is not clear, for it is certain, as both Flint and Da Costa[2] long since remarked, that the phenomenon bears no constant relation to the extent of the cardiac disease. "Not only are these lesions (cardiac) marked in cases in which dropsy has not occurred, but dropsy occurs in other cases in which the lesions are comparatively slight" (Flint[3]).

In seeking an adequate explanation for the occurrence of these effusions we have concerned ourselves chiefly with the effects, the mechanical effects, arising from pressure exerted by the dilated heart. We recognize fully that before an effusion can occur the presence of factors other than pressure may be necessary, for

[1] Read at a meeting of the Pathological Society of Philadelphia, May 27, 1909.

[2] Medical Diagnosis, eighth edition, p. 422.

[3] Diseases of the Heart, second edition, 1870, p. 37.

example, toxic, vasomotor, bacterial, or metabolic influences, or a hydremic condition of the blood. Krehl[4] states in this connection: "Certain patients suffering from heart disease in the state of broken compensation show a watery condition of the blood, both the specific gravity and the proportion of proteids in the blood being diminished (Grawitz). A weakness of the right ventricle is especially apt to give rise to such a thing in the blood. . . . This hydremia occurs in a comparatively small proportion of all cases of broken compensation; but where it does occur it is quite usual for it to disappear with any improvement in the circulation."

Any one of those agents, however, which affect the composition of the blood will fail to account for the fact that these effusions have a marked preference for one or the other side of the chest, usually the right. That pressure alone will cause the transudate is improbable, but it is certainly a factor of the greatest importance. Another point is that the pressure must be from dilatation, as it has long been recognized that hypertrophy of the heart by itself is incapable of producing an effusion, and that dilatation, with or without valvular lesions, is an essential feature.

Recognizing that dilatation of the heart was necessary, most observers contented themselves with the explanation that a transudation resulted from venus stasis, either alone or in association with impoverishment of the blood. In recent years, however, the azygos-vein theory has been much in favor, largely as a result of papers published by Steele[5] and Stengel.[6] Their explanation of these effusions, and particularly of the right-sided preponderance, is that the dilated right heart by extension upward exerts pressure on the root of the right lung and thus indirectly pinches the azygos major vein as it curves over the root of the right lung to enter the superior vena cava. Baccelli,[7] in 1863, first called attention to this possibility, although his explanation differed somewhat from that of Steele and Stengel. His idea was that the enlarged heart, by dragging the superior vena cava downward, carried with it the vena azygos major, thus drawing it tightly around the root of the lung and causing it to be compressed.

What has commended this theory to many is the fact that the vena azygos major receives as tributaries the intercostal veins of the greater portion of the right chest, vessels which drain the major portion of the right costal pleura. The natural assumption has been that with compression of this vein in its upper part there would result a venous stasis on the right side which would lead to a transudation. The theory has gained additional strength from

[4] Clinical Pathology, American edition, 1905, p. 176.

[5] University Medical Magazine, 1897, Journal of the American Medical Association, October 1, 1904.

[6] University of Pennsylvania Medical Bulletin, 1901.

[7] Quoted by Steele, Jour. Amer. Med. Assoc., October 1, 1904.

the fact that these effusions are so frequently right-sided, or, when bilateral, greater on the right side. When the condition was bilateral the smaller, left-sided effusion was explained on the basis that the vena azygos minor, which drains less of the left chest than does the major of the right, and empties into the latter at the eighth or ninth thoracic vertebra, would become affected only secondarily and to a slighter extent.

Every concrete theory hitherto advanced to explain the condition has been based on the assumption that the fluid is derived from the parietal pleura; and, of the vessels of this part of the membrane, the azygos veins have been held by most writers to be the source of the fluid. To this explanation five objections can be raised: (1) Only about two-thirds of the parietal membrane is drained by the azygos veins; (2) the collateral anastomoses of the azygos veins are so free and so numerous that, in the event of pressure, competent by-paths would soon be established and carry away any excess of fluid in the azygos radicles; (3) the vena azygos minor, emptying into the major, is subject to the same influences as the latter, and therefore the effusion should always be bilateral; (4) it is anatomically impossible for the heart, either directly or indirectly, to exert pressure upon the azygos major vein; (5) it does not explain purely left-sided effusions.

1. First, as to the azygos veins draining only about two-thirds of the parietal pleura. Like all serous membranes, the pleura consists of two portions, a parietal and a visceral, and the circulation in the two differs greatly, each receiving and discharging blood in vessels which belong to the structures with which the membrane is in contact. An example of this principle is afforded by the pericardium, of which the vessels of the parietal layer are derived from the thoracic aorta and the internal mammary, while those of the visceral layer or epicardium are branches of the coronaries. The pleura has a similar arrangement, but for the present the vessels of only the parietal layer will be considered. The arteries are derived from the superior and aortic intercostals, the internal mammary, the mediastinal, the œsophageal, the bronchial, and the phrenic, and the return circulation is through corresponding veins.

The most important thing to have clear in this connection is the vessels into which these veins drain. The intercostals vary somewhat at their vertebral ends, but the average arrangement is for the first intercostal on both right and left sides to empty into the innominate, while the second, third, and fourth on the right side form a trunk which opens into the vena azygos major, and the remainder on this side open separately into the same vessel. On the left side the second, third, and some times the fourth form a trunk, the superior intercostal vein, which opens above into the innominate and is connected with the left upper azygos vein. The

intercostals from the fifth to the eighth on the left side form the left upper azygos and open into the azygos major or minor, while the remaining intercostals open individually into the azygos minor. At their sternal ends the upper nine or ten intercostals of both sides open freely into the internal mammary, or its musculophrenic tributary, the lower two or three having no such termination.

Of the remaining veins of the parietal pleura, the internal mammaries empty into the innominate, the mediastinal into the same vessel, the œsophageal into the azygos and also into the inferior thyroid and the gastric, the bronchial into the azygos, the inferior phrenic into the inferior vena cava, and the superior phrenic into the left innominate. The cervical pleura drains into the innominate, the posterolateral part of the right costal pleura into the azygos major, the upper third of the posterolateral part of the left costal pleura into the innominate above and the azygos minor below, and the lower two-thirds into the azygos minor. The anterior part of the costal pleura empties its blood into the internal mammaries, the mediastinal pleura into vessels which eventually reach the innominate and the portal, and the diaphragmatic pleura into veins which are tributary to the innominate and the inferior vena cava.

Analysis of this summary shows that the venous drainage of the parietal pleura is into widely separated vessels, and consists of veins which open into the azygos major and minor, the innominate, the inferior thyroid, the gastric, and the inferior vena cava. The deduction to be drawn from this is that while the azygos veins are of importance in carrying away the blood from the parietal pleura, only a portion of the membrane is drained by this system, perhaps not more than two-thirds.

2. Second, as to the numerous and wide anastomoses of the azygos veins. In order to render clear this portion of the discussion, it is perhaps advisable to give a brief resume of the tributaries and anastomoses of the azygos veins. The tributaries of the azygos major are the lumbar, the right intercostals with the exception of the first, the œsophageal, the posterior mediastinal, the venous plexus around the thoracic aorta, the posterior pericardiac, the bronchial, and the azygos minor. In connection with these vessels it is important to know how extensive and how practicable are their peripheral anastomoses. The azygos major begins just below the diaphragm, and at this point anastomoses with the right ascending lumbar vein, which connects it with the four right lumbar veins and, through the lowest of these, with the iliolumbar or the common iliac vein. The azygos minor has the same connections on the left side, and by these anastomoses a ready side track into the inferior vena cava is established.

As regards the intercostals, "In the middle portion of their course the upper six or seven veins give off branches, the costo-axillary

veins, which ascend toward the axilla and open into either the long thoracic or the thoracico-epigastric vein and so into the axillary, and, as it approaches the vertebral column behind, each vein receives a dorsal branch which accompanies the spinal branch of the intercostal artery and returns the blood from the skin and muscles of the back and also from the spinal column and its contents, this drainage being by means of a spinal branch which connects with the intervertebral veins."[8] "Laterally, at each intervertebral foramen the internal (spinal) plexuses send branches out from the spinal canal along the nerve trunks, and by means of these intervertebral veins, which have the form of plexuses at their origin and receive communicating branches from the external vertebral plexuses and from the veins of the spinal cord, the internal plexuses pour their blood into the vertebral, intercostal, lumbar, and lateral sacral veins, the connection with the intercostals being through their rami spinales."[9] In addition to these anastomoses the upper nine or ten intercostals open anteriorly into the musculophrenic or internal mammary veins. It is evident, therefore, that obstruction to the flow of blood through the intercostals would result in the blood seeking and finding other courses, which are many and wide—the axillary, the vertebral, the lumbar and the lateral sacral.

The œsophageal veins anastomose with the inferior thyroid veins above and the gastric below. There are thus afforded paths into the innominate and the superior vena cava by way of the inferior thyroids and into the portal by way of the gastric. The posterior mediastinal veins open into the left innominate, and the destination of the plexus around the aorta is probably into the azygos and œsophageal veins. The posterior pericardiac veins anastomose freely with the anterior pericardiac, which open into the internal mammary, and through these a path is established into the left innominate or into the superior vena cava. The bronchial veins anatomose in the lung with some of the radicles of the pulmonary vein and thereby afford a wide open channel for any dammed back blood. The vena azygos minor (vena hemiazygos) begins in the left upper abdomen and enters the thorax through the left crus of the diaphragm. Thence it ascends at the left side of the thoracic aorta and at the level of the eighth or ninth thoracic vertebra crosses to the left beneath the thoracic duct and thoracic aorta and empties into the vena azygos major. The tributaries of this vessel are the ascending lumbar vein, the left lower four or five intercostals, the œsophageal, the posterior mediastinal, and occasionally the left upper azygos. The peripheral anastomoses of these vessels are, with the exception of the left upper azygos, the same as have been described in connection with the azygos major.

⁸ Piersol's Human Anatomy, p. 896.   ⁹ Ibid., p. 898.

The left upper azygos vein (vena azygos minor superior, or accessory hemiazygos) begins at the second intercostal space on the left side and descends to the left of the middle line. At about the eighth thoracic vertebra it crosses to the right posterior to the aorta and œsophagus, to empty into the azygos major. Sometimes it empties into the vena azygos minor as the latter curves toward the right, and even when it empties into the azygos major it is frequently connected directly with the azygos minor. Its tributaries are the upper seven or eight intercostal veins, the left posterior bronchial veins, and a twig which connects it with the left innominate. The potentialities of these have been indicated in the description of the azygos major.

It would seem from this summary that the possibilities of a wide and ready collateral circulation through many by-paths, some leading into the superior and some into the inferior vena cava, are so great that it is almost unthinkable that any degree of obstruction could be sufficient to cause leakage into the pleural sac. In this connection it should be remembered that the pleura and its vessels are constantly subjected to a suction or negative pressure equivalent to 6 mm. of mercury, and must, therefore, be stronger and better equipped to resist pressure than any others in the body. Were this not so the pleural cavities of everyone presenting favorable blood conditions would fill with fluid until the pressure in the sac would be equal to the pressure within the lung.

In connection with the above resume of the azygos anastomoses it is interesting to note that Broadbent,[10] in referring to the pressure of aneurysms on the venous trunks, states that "there may be pressure on the azygos vein which passes up behind the root of the lung to open into the superior vena cava just before it enters the pericardium. This does not appear to give rise to any characteristic physical signs or symptoms, probably on account of the free anastomosis with the lumbar veins, which enables the blood to return without difficulty via the iliac veins and the inferior vena cava." This anastomosis mentioned by Broadbent is obviously but one of many.

3. Third, as to the vena azygos minor being subject to the same influences as the major. It will be remembered that the former vein, after receiving the left upper azygos, the lumbar, and the lower intercostal veins, crosses the vertebral column and empties into the azygos major. Being a tributary to the latter and the largest branch of the azygos tree, it must of necessity be subjected to the same pressure influences. Granting that obstruction at the azygos arch is responsible for these right-sided transudates, it is difficult to understand why the effusion should ever be limited to one side, especially the right, since stasis would probably first be manifest at the

greatest distance from the point of pressure, that is, in the radicles of the vena azygos minor.

4. Fourth, as to the possibility of the heart exerting pressure upon the azygos major vein. In order to discuss this intelligently, a review of the course and relations of the vein is essential. The vena azygos major (vena azygos) begins in the right upper abdomen and passes into the thorax either through the aortic opening in the diaphragm or between the median and intermediate portions of the right crus. It ascends in the posterior mediastinum to the right of the median line, having behind it the right intercostal arteries and the bodies of the thoracic vertebræ. To its left lie the aorta, the œsophagus, and the thoracic duct. On reaching the level of the seventh thoracic vertebra it inclines slightly to the right, and at the level of the fifth or fourth bends forward and passes between the mesial surface of the right lung and the right aspect of the trachea at or just above the obtuse angle (155 degrees) at which the right bronchus leaves the trachea. Either at or posterior to the plane of the anterior surface of the trachea it enters the superior vena cava just above the point at which the pericardium leaves the latter vessel. A number of measurements taken in the dissecting room of the University of Pennsylvania showed this point of entrance to be about 6 cm. above the entrance of the superior cava into the right auricle. The terminal portion of the vessel, as it arches over the right bronchus, is called the "azygos arch." Valves, usually to the number of four, are present in the vessel, but they are frequently unpaired and usually incompetent. In 22 per cent. the valves are absent.[11]

To justify the statement that the heart cannot press on the azygos major vein it is necessary to review briefly the anatomical relations at the roots of the lungs. These roots are made up of the bronchus, the pulmonary and bronchial vessels, nerves, lymphatics, and areolar tissue. The superior vena cava descends anterior to the root of the right lung to terminate in the upper portion of the right auricle, and this upper part of the auricle lies in an anterior relation to the root, an important fact, of which use will be made later. After leaving the vertebral column to course forward the azygos major passes in an arciform manner over the right pulmonary root to empty into the superior vena cava about 6 cm. above the termination of the latter in the right auricle. A dilated right heart, to exert any pressure on the azygos arch, would necessarily displace upward and backward the pulmonary veins, the bronchus, the pulmonary arteries, and all the minor elements in the lung root. To realize that this is an impossibility one has but to study the actual preparation made in a body in which the viscera have been hardened in situ, and to take into consideration not only the intrinsic

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[11] Gruber, quoted by McMurrich in Piersol's Human Anatomy, p. 983.

strength and resistance of these structures, but also their firmness
of attachment. The ligamentum latum pulmonis alone, a firm
reflection of the pleura connecting the lung root with the diaphragm,
would be a potent factor in restraining any upward excursion of
the bronchus and its associated structures. Study of the accom-
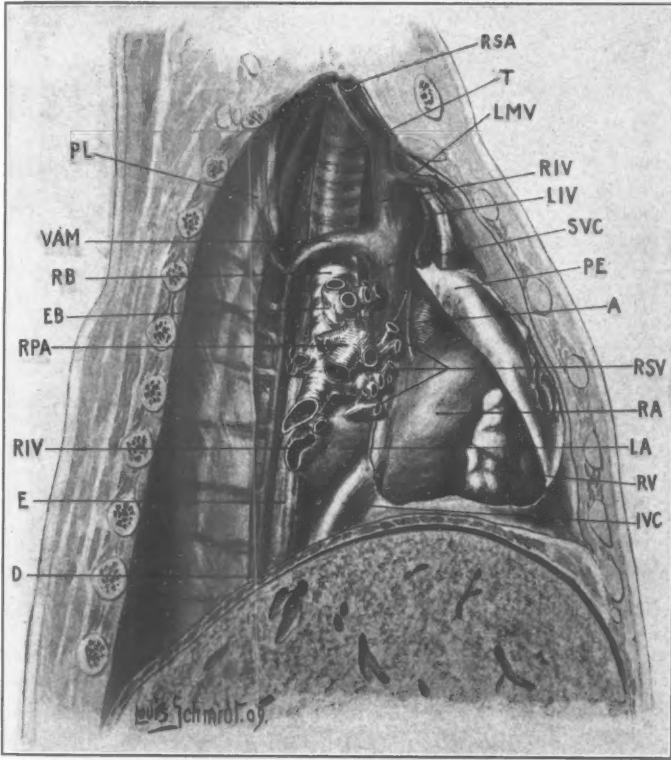
FIG. 1.—View from the right of the mediastinal contents and the root of the right lung.
D, diaphragm; *E*, œsophagus; *RIV*, right inferior pulmonary vein; *RPA*, right pulmonary
artery; *EB*, eparterial bronchus; *VAM*, vena azygos major; *PL*, pleura; *RSA*, right sub-
clavian artery; *T*, trachea; *LMV* (should be *RMV* in the illustration), right internal
mammary vein; *RIV*, right innominate vein; *LIV*, left innominate vein; *SVC*, superior
vena cava; *PE*, pericardium; *A*, aorta; *RSV*, right superior pulmonary vein; *RA*, right
auricle; *LA*, left auricle; *RV*, right ventricle; *IVC*, inferior vena cava.

panying figures (Figs. 1 and 2) should convince one that the pressure
claimed to be possible is out of the question. Theoretically there
might be some direct pressure exerted by the heart upon the
ascending part of the azygos, but cross-sections of the thorax (Fig.
3) show this to be impossible. The vein is so completely and

well protected by the œsophagus and the aorta that such a contingency need not be considered.

Incidentally it might be stated that autopsy reports in which the assertion is made that the azygos major vein is dilated are, as a
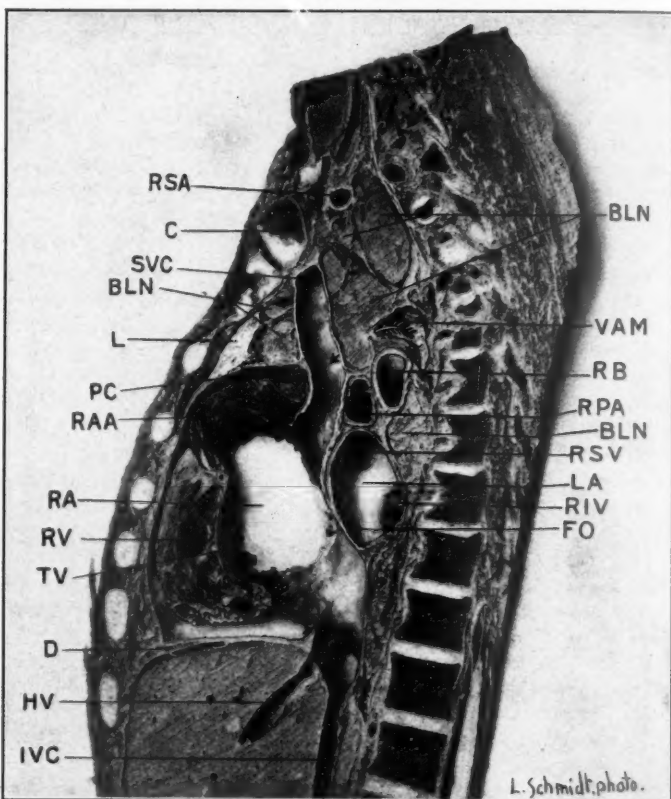
FIG. 2.—Anteroposterior section through the thorax in a plane 2 cm. to the right of the sternum. *IVC*, inferior vena cava; *HV*, hepatic vein; *D*, diaphragm; *TV*, tricuspid valve leaflet; *RV*, right ventricle; *RA*, right auricle; *RAA*, right auricular appendix; *PC*, pericardial chamber; *L*, lung; *BLN*, bronchial lymph nodes; *SVC*, superior vena cava; *C*, clavicle; *RSA*, right subclavian artery; *VAM*, vena azygos major; *RB*, right bronchus; *RPA*, right pulmonary artery; *RSV*, right superior pulmonary vein; *LA*, left auricle; *RIV*, right inferior pulmonary vein: *FO*, fossa ovalis.

rule, untrustworthy.   One writer (Steele[12]) states that he found this vein dilated "to the size of a goose quill."   When one realizes that the normal diameter of this vessel is about 1 cm., it can readily

12 Jour. Amer. Med. Assoc., October 1, 1904.

be seen that such reports are untrustworthy. The average impression is that the azygos major is about the size of a radial artery, and many have been the expressions of amazement when our preparations have been shown to friends and the fact demonstrated that this vessel has at its upper end a normal caliber equal to that of a carotid or even a subclavian artery.
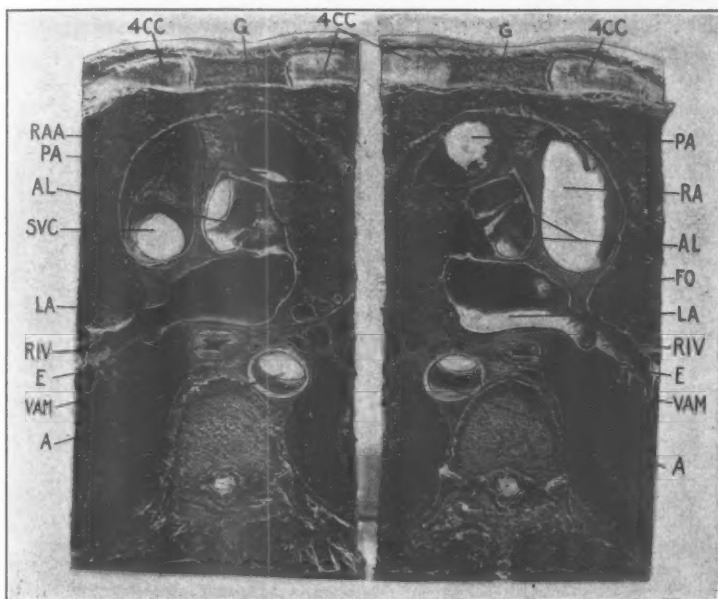
Fig. 3.—Lower (on the left) and upper (on the right) views of a transverse section through the mediastinal portion of the thorax at the level of the fourth costal cartilage. *A*, aorta; *VAM*, vena azygos major; *E*, œsophagus; *RIV*, right inferior pulmonary vein; *LA*, left auricle; *SVC*, superior vena cava; *AL*, aortic leaflets; *PA*, pulmonary artery; *RAA*, right auricular appendix; *4CC*, fourth costal cartilage; *G*, gladiolus; *RA*, right auricle; *FO*, fossa ovalis.

5. Fifth, as to the inability satisfactorily to explain why the effusion is, in a not inconsiderable number of cases, entirely confined to or much greater on the left side. Thus, of 108 cases recorded by Steele and Lord,[13] no less than 30 of them (27.7 per cent.) were left-sided, either entirely or to a great extent. Steele,[14] in his second paper, advanced the theory that this might be explained by the dilatation of the heart being greater on the left side than on the right. "In 11 cases of effusion confined to the left pleura, or greater on that side, the left heart, and especially the left ventricle,

[13] Osler's Modern Medicine, vol. iii.
[14] Journal of the American Medical Association, October 1, 1904.

was especially mentioned as enlarged in 9 cases, that is, in four-fifths of the cases of left-sided effusion." He admits, however, that it is difficult to explain these cases on this theory, as there is no large venous trunk analogous to the vena azygos major to be compressed. He also mentions Rosenbach's explanation, namely, that the pressure exerted by the enlarged left ventricle on the left lower lobe produces atelectasis. As a result of long-continued congestion produced by collapse of the lung there arises a low grade inflammation of the pleura, and finally, an effusion forms in the pleural sac which is partly transudate and partly inflammatory. Steele's comment on this is that his own "list of cases gives nothing to confirm or deny the theory of Rosenbach. I can only call attention to the fact that left-sided cardiac dilatation seems to bear some relation to left-sided pleural effusions."

AUTHORS' EXPLANATION. The explanation which we wish to offer to account for these effusions is as follows: The fluid comes not from the parietal, but from the visceral pleura, and the out-pouring is caused, so far as the pressure factor is concerned, by dilated portions of the heart pressing on and partly occluding the pulmonary veins.

Two sets of bloodvessels enter the lungs, the bronchial arteries and the pulmonary arteries. The former are nutritional in function and are derived from the aorta or from the first aortic intercostal. They enter the hilum of the lung and follow the posterior surface of the bronchi, some of their terminal branches reaching and supplying the pleura. The pulmonary arteries, in addition to carrying venous blood to the lungs, send twigs to the pleura. In this membrane there is a capillary anastomosis between the terminal branches of the bronchial and pulmonary arteries, on the one hand, and the venous radicles which are tributary, not to the bronchial, but to the pulmonary veins, on the other. This has been shown by Miller,[15] who says: "The capillary network into which the bronchial artery breaks up in the pleura gives rise to radicles which join the pulmonary vein." He also states: "I have failed to demonstrate by the use of granular injection masses any anastomosis between the bronchial and pulmonary arteries. On the other hand, by using injection masses which flow freely I have injected both sets of vessels (pulmonary artery and vein), but only by a backward flow (from the bronchial artery) of the injecting mass through the capillary network." It is evident, therefore, that the venous blood from the visceral pleura is poured into the pulmonary veins, and, as a corollary, that any obstruction to the flow through this vein, if of sufficient power and duration and if accompanied by whatever condition of the blood essential to transudation, would produce leakage through the visceral pleura into the pleural sac.

[15] American Journal of Anatomy, vii, 404, 405.

Points in favor of our theory are that it explains equally well right-sided, left-sided, and bilateral collections of fluid, and also accounts for certain intrapulmonary conditions found clinically and postmortem in association with hydrothorax. Starting with the assumption that the transudate comes from the visceral pleura as a result of pressure on the pulmonary veins, a study of the anatomical relations between the heart and the roots of the lungs illumines the discrepancies which have long been noted. Anatomically the relations and pressure possibilities differ widely on the two sides.

The Anatomy of Right-sided Effusions. These are due to pressure exerted by a dilated right auricle upon the right pulmonary veins and upon the right end of the left auricle. That a dilated right auricle does press upon the right pulmonary veins is shown to be not only possible but inevitable by a study of the mutual relations of the right auricle and the right pulmonary root. It is shown with special clarity if the thoracic contents are hardened in position before the chest is opened. Studies under these conditions were made in three ways, by anteroposterior sections, a valuable method of studying thoracic relations which has been too much neglected, by transverse sections, and by lateral dissections of the mediastinum after removal of the lungs. The following facts were definitely brought out: Of the four chambers of the heart, three appear on the anterior surface and one on the posterior. The anterior cavities are, from right to left, the right auricle (the appendix mainly), the right ventricle, and the left ventricle, and all are plainly visible on anterior inspection. The main cavity or atrium of the left auricle is entirely a posterior structure (Figs. 2, 3, and 4), being invisible from the front, and it comes in relation anteriorly with the three other chambers as well as with the first portion of the aortic arch. Posteriorly it meets firm resistance and is separated from the bodies of the thoracic vertebræ by the contents of the posterior mediastinum, particularly the descending aorta and the œsophagus (Fig. 3). Above it is bounded throughout its entire length by the right pulmonary artery (Figs. 2 and 4), above which is the aortic arch. In front of its right-hand end, into which the right pulmonary veins open, are the right auricle and a little of the superior vena cava (Fig. 2), and in the lower portion of the interauricular wall is the thin fossa ovalis (Figs. 2 and 3), remaining from the foramen ovale.

If the right auricle were to become dilated it could expand forward but slightly, owing to the presence of the chest wall; it could not advance to the left on account of the right ventricle being there; below are the diaphragm and liver; above are the superior vena cava and an overlapping wedge of lung tissue. The path of least resistance is to the right, upward and backward, and in so expanding there would be inevitable compression of the structures which lie

behind the right portion of the auricle. These are the right end of the left auricle and the root of the right lung (Figs. 1, 2, and 3). Of the component elements of the latter the most anterior are the pulmonary veins and behind these are the bronchi. The lower portion of the right end of the left auricle extends somewhat below the bronchus, and is bounded posteriorly by the œsophagus and anteriorly by the right auricle. In case, therefore, the latter expands, the two parts of the circulatory system which cannot escape compression are the right pulmonary veins and the right end of the left auricle, compression of the latter being facilitated by the thin fossa ovalis between the two auricles. The result of such compression would be stagnation in the right pulmonary veins and consequent leakage, on the outside, from the visceral pleura, and on the inside, into the lungs, the latter a point to be taken up later.

The Anatomy of Left-sided Effusions. The left auricle is unfortunately named, except in that the name indicates its physiological position. It is the posterior auricle, forming as it does the back surface of the heart, being the only portion of the heart to touch the posterior body wall and lying behind the three other cavities of the heart. It is a slightly flattened, transversely placed cylinder with tributaries entering at both ends (Figs. 2 and 4). From its left upper anterior portion arises its auricular appendix (Fig. 4), which passes forward and curls around the left anterolateral aspect of the root of the pulmonary artery (Fig. 5). Posteriorly the appendix rests against the left upper pulmonary vein and anteriorly it comes close to the chest wall, from which it is separated only by pericardium and pleura and a small thin wedge of lung. Above, outside the pericardium, is the pulmonary artery, below is the left ventricle, and the only direction in which free expansion is possible is toward the left (Fig. 5). The left auricle is so hedged in on all sides that dilatation would first affect the appendix, which must act as a safety valve. The main cavity, or atrium, abuts firmly against the aorta, the œsophagus, and the vertebræ posteriorly (Fig. 3), and marked expansion in this direction would cause dysphagia from pressure on the œsophagus, a symptom not complained of in these conditions. In front are the other chambers of the heart, so placed that enlargement anteriorly would be prevented by the impinging of the anterior cavities against the chest wall. Upward bulging would be blocked by the right pulmonary artery and the aortic arch, and below is the diaphragm, braced and supported by the liver. The natural expansile relief to overfilling would take place first to the left, and this would necessarily mean distention of the auricular appendix.

Occupying a position posterior and to the left of the appendix, separated from it only by the pericardium and the pleura, is the left upper pulmonary vein (Fig. 5). Behind, to the left, and in immediate contact with this vessel is the left bronchus (Fig. 5).

Distention of the left appendix would necessarily squeeze the left upper pulmonary vein between the appendix and the bronchus and be a factor in causing transudation. The left lower pulmonary vein is in its extrapericardiac portion out of reach of the appen-
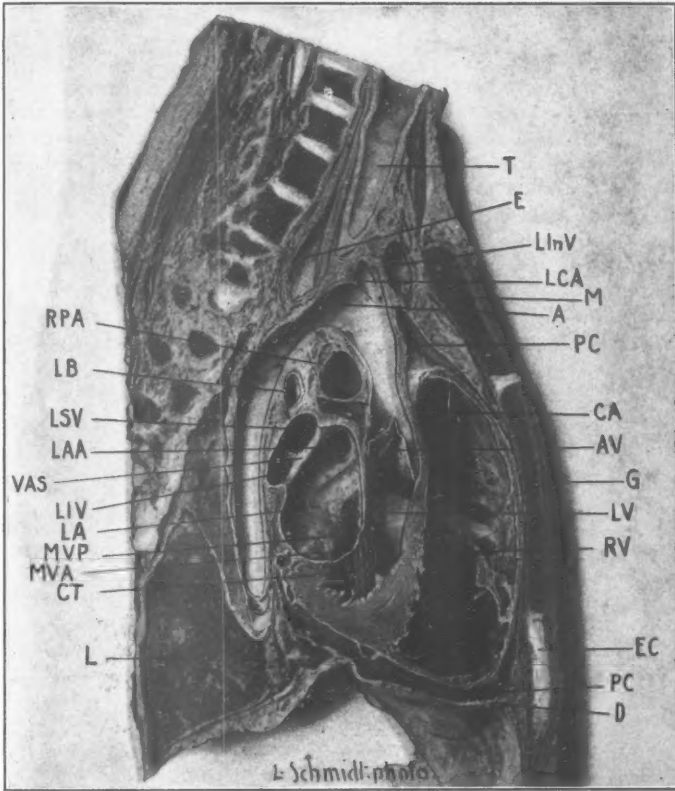
FIG. 4.—Median 'anteroposterior section through the thorax. *L*, lung; *CT*, chordæ tendineæ; *MVA*, mitral valve, anterior leaflet; *MVP*, mitral valve, posterior leaflet; *LA*, left auricle; *LIV*, left inferior pulmonary vein; *VAS*, veno-appendicular septum; *LAA*, left auricular appendix; *LSV*, left superior pulmonary vein; *LB*, left bronchus; *RPA*, right pulmonary artery; *T*, trachea; *E*, œsophagus; *LInV*, left innominate vein; *LCA*, left common carotid artery; *M*, manubrium; *A*, aorta; *PC*, pericardial chamber; *CA*, conus arteriosus; *AV*, aortic valve leaflets; *G*, gladiolus; *LV*, left ventricle; *RV*, right ventricle; *EC*, ensiform cartilage; *D*, diaphragm.

dix, but it is so placed that dilatation of the left ventricle would involve the vein in compression between the ventricle and the bronchus (Fig. 5). In addition, there is in the left end of the left auricle, a structure which may be a factor in left-sided effusions.

This is the almost vertical partition, which might be called the veno-appendicular septum, between the opening into the auricle of the appendix anteriorly and the left pulmonary veins posteriorly (Fig. 4). A dilatation of the appendix which would thrust this
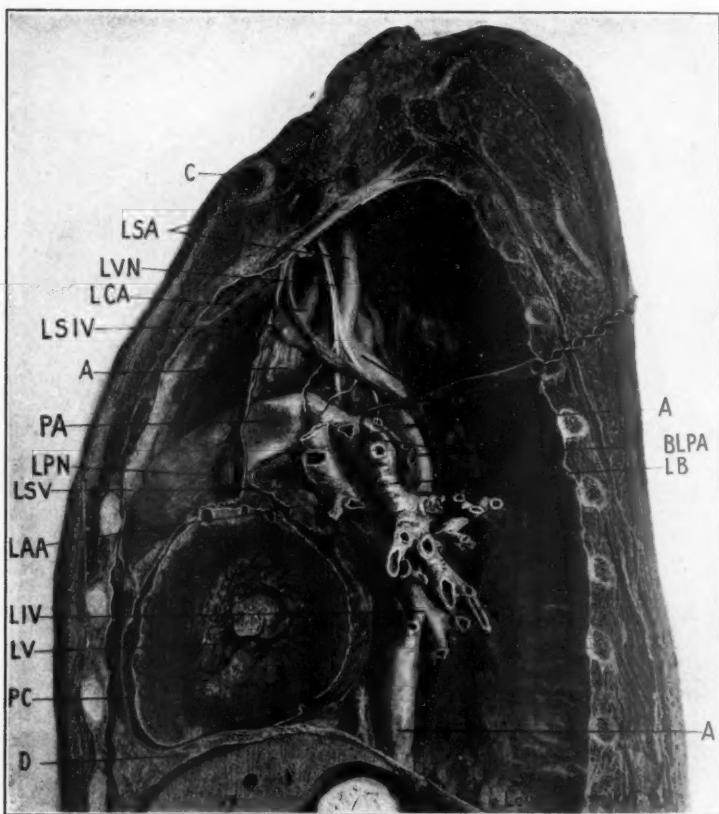
FIG. 5.—View from the left of the mediastinal contents and the root of the left lung. (Retouched photograph.)   *D*, diaphragm; *PC*, pericardial chamber; *LV*, left ventricle; *LIV*, left inferior pulmonary vein; *LAA*, left auricular appendix; *LSV*, left superior pulmonary vein; *LPN*, left phrenic nerve; *PA*, pulmonary artery; *A*, aorta; *LSIV*, left superior intercostal vein; *LCA*, left common carotid artery; *LVN*, left vagus nerve; *LSA*, left subclavian artery; *C*, clavicle; *A*, aorta; *BLPA*, branch of left pulmonary artery; *LB*, left bronchus.

septum backward would seriously hinder the flow of blood from the left pulmonary veins into the left auricle and be a factor in causing transudation from their radicles.

Greater frequency on the right side is due to the fact that dilata-

tion of the right auricle is more common and more easy than a similar condition of the left side, and such dilatation is the only factor needed to cause damming back in the right pulmonary veins.   On the left side, in order to include both upper and lower veins, there is needed dilatation of the left auricular appendix and of the left ventricle, with possibly a retrodisplacement of the vertical septum mentioned above, three factors as against one on the right side.

As far as we know, but one writer has come any where near the same conclusion as have we.   West,[16] in considering the various factors leading to hydrothorax states that "It is not agreed from which set of vessels the effusion comes, but I think it must be from the pulmonary artery or vein; and though the obstruction leads rather to œdema of the lung than to pleuritic effusion, still the two are frequently associated together."   Surely, if there is leakage from the pleura there should be a similar filtration into the lung tissue and air spaces, a condition which should cause changes in the breath sounds and the presence of moist rales.   If the latter part of West's statement is correct, that is, that œdema of the lung and pleural effusion are frequently associated, it would seem to bear out our theory as to the factors at work.   May it not be more than possible that the rales so frequently heard above an effusion and hitherto ascribed to compression of the lung, are due to intrapulmonary leakage from the same pressure on the pulmonary veins that is causing the presence of the fluid in the pleural sac?

Recently one of us had the opportunity of studying a case of failing compensation in the service of Dr. H. A. Hare, in the Jefferson Hospital.   There were found signs of a small effusion in the right chest, and the lung above the fluid was the seat of small moist rales.   The other lung was absolutely clear.   The fact that such cases as this are not uncommon would tend to support the theory advanced in this paper.

A PRACTICAL HOSPITAL POLYGRAPH.

By Theodore B. Barringer, Jr., M.D.,
OF NEW YORK.

(From the Department of Medicine of Cornell University Medical College, New York.)

A hospital polygraph, in order to be thoroughly practical, must be readily transportable from bed to bed, and should not be so elaborate and heavy in construction as to necessitate moving the patient to it.

[16] Diseases of the Organs of Respiration, ii, 757.

It also must have a capacity for several long records, and as simple a mechanism as is consistent with accuracy.   None of the polygraphs
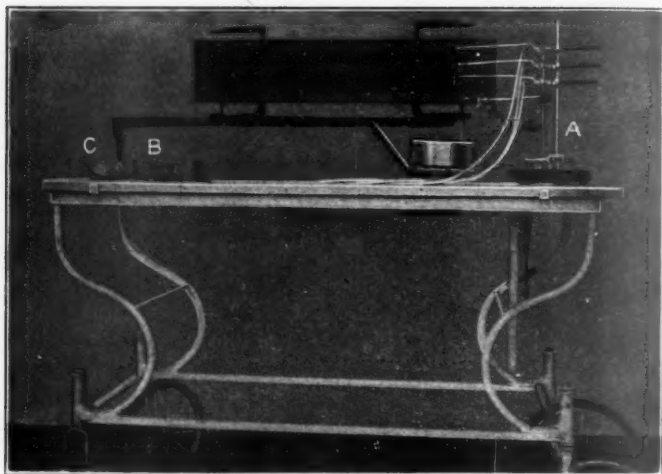
FIG. 1
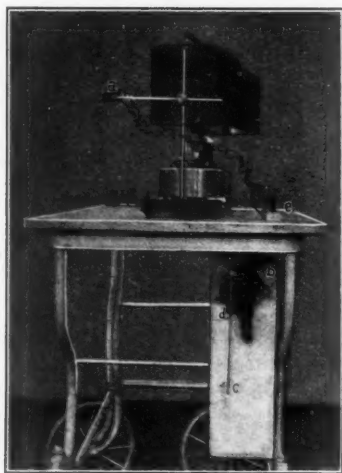
FIG. 2

I have seen has satisfied these requirements, and I have put together the apparatus illustrated in Figs. 1 and 2.   There is nothing particularly original about this polygraph, for most of the parts are well

known.   They have simply been collected so as to make an instrument possessing the desired requisites, and its successful use during the last year in the wards of Bellevue Hospital shows that this end has been attained.   The carriage is made from an ordinary rubber-tired hospital stretcher, whose iron top has been replaced by a pine board, securely fastened to the stretcher frame.   This carriage permits a rapid and easy moving of the polygraph from patient to patient, and saves much time.   The drum is the long paper kymograph made by the Harvard Apparatus Co.   The tambours are made with a very shallow cup and a screw adjustment, which governs the position of the writing points.   They are quite sensitive, and embody the idea of Mr. J. L. Hoyt,[1] by whom they were made.   In Fig. 1 they are shown, mounted on a heavy tangent stand (a), made for me by the Harvard Apparatus Co.   The cups (or receivers), which receive pulsations from the jugular, apex beat, or liver, are of various shapes and sizes (Fig. 1, b).   In transmitting the radial pulsations, I have used with fair success a Mackenzie transmission sphygmograph (Fig. 1, c). The time marker, shown in Fig. 2, consists of a signal magnet (a) actuated by an electric current, which is interrupted at regular intervals by the vibrating mechanism of a modified electric bell.   I am indebted to Dr. H. B. Williams, of the Department of Physiology, for the idea and for its practical application.

The electric bell, with the bell removed and the clapper cut off, is shown at b. A rod (c) carrying an adjustable weight (d) is attached in place of the clapper.

Underneath the table, behind the vertical board to which the bell is attached, a dry cell is slung. At e is a switch. By moving the weight on the rod, the time unit can be varied. This one is set at one-tenth second, which I have found very satisfactory.

LOCOMOTOR ATAXIA AND PARALYSIS AGITANS IN THE SAME PATIENT.[1]

By AUGUSTUS A. ESHNER, M.D.,

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FOR GRADUATES IN MEDICINE.

IT is generally admitted that locomotor ataxia is due to disease of the posterior nerve roots and of the posterior columns of the spinal cord. Various lesions in the nervous system have been described in fatal cases of paralysis agitans, but there is no common agreement in this connection, while, on the other hand, evidence

[1] Of the Department of Physiology of the College of Physicians and Surgeons.
[1] Read at a meeting of the Association of American Physicians, Washington, D. C., May 11 and 12, 1909.

has been presented in favor of the view that the symptoms of the disorder are attributable to changes in the muscles themselves. The one disease is, in the vast majority of cases, caused by ante-cedent syphilis, while of the other, it may be definitely stated that, although the ultimate etiological factors are unknown, syphilis certainly is not to be included among them. Neither have the two affections anything in common symptomatologically. In fact, they may be looked upon somewhat as clinical antitheses, the one being characterized by a condition of muscular hypotonia, the other by a condition of muscular hypertonia. Their associated occurrence in a given case, therefore, can be viewed only as a mere coincidence. Inasmuch as both diseases are not altogether common, it is not surprising that such association should be infrequent. To the small number of cases of this kind recorded in the literature, I am, through the courtesy of Dr. John K. Mitchell, permitted to add another instance.

A married white man, aged seventy years, occupied as a farmer, applied at the Orthopedic Hospital and Infirmary for Nervous Diseases, October 24, 1904, complaining that for more than a year he had been suffering from attacks of shooting pain in the left lower extremity, with numbness of the left thigh and a sense of weakness, and also impairment of vision. Sexual desire had been absent for two years. The functions of the bladder and the rectum were preserved. There was a sense of tingling on the forehead, but no vertigo. The gait was somewhat awkward and ataxic. Station was rather good with the eyes open, but poor when the eyes were closed. Coördination was preserved in the upper extremities, but there was some tremor of the hands. Sleep was poor. The appetite was fairly good. The bowels were constipated. The radial arteries were tortuous and felt atheromatous. The knee-jerks were absent and the elbow-jerks were diminished. The pupils were small, reacting in accommodation, but not to light. There was no diplopia, and the ocular movements were well performed. The visual fields were concentrically contracted from advanced optic atrophy. The field for green was entirely abolished. The changes were more ad-vanced in the left eye than in the right. There was a large hernia in each inguinal region. The action of the heart was rhythmic, its sounds clear. The patient denied all history of venereal infection and of any other disease as well. He had been exposed a good deal to cold, but he had suffered no traumatism and from no form of intoxication, although he indulged moderately in the use of tobacco and of alcohol.

Under treatment with moderate doses of potassium iodide improve-ment in the subjective symptoms took place, but various paresthesias, such as a feeling of swelling and drawing about the mouth, itching of the eyes and nose, numbness in the lower extremities, about the hips, on the back and chest, and the genitalia, a sense of crushing

of the breast, of weight and pressure on the chest, of stiffness of the lower jaws, a feeling of looseness of the teeth, stinging pain in the face, made their appearance, and the tremor became rather more marked. There was considerable lacrymation, which was only partially diminished by dilatation of the lacrymal ducts and the use of collyria. Headache became a rather marked and constant symptom.

In the summer of 1905 the man was in the hospital for ten weeks, where, in addition to other treatment, he was given a course of coördination exercises, and he improved in many directions. Later many of the previous symptoms returned, and they gradually grew worse. In April, 1906, it was noted that the patient could walk well, maintaining his equilibrium except in rising suddenly from the sitting posture. Vision grew worse and appeared to be obscured by a mist. There was complaint of pain in various parts of the body, with itching in some and numbness in other situations. In May the gait was awkward and ataxic, station unsteady and swaying. It was now particularly noted that, on standing with the eyes closed, the right hand became involved in tremor not apparent on voluntary movement. The gait gradually grew more ataxic and staggering, and the condition of the patient became worse in other respects. The countenance was observed to be fixed, and there was also some tremor of the head. For the first time the presence of paralysis agitans was definitely recognized. There was persistent complaint of numbness of the buttocks, perineum and adjacent thighs, and girdle sense developed. Dryness of the mouth and stiffness of the jaws also caused annoyance. Discomfort was occasioned by the sense of a foreign body in the throat that would not come up or go down. In May, 1907, there was much difficulty in walking, on account of swaying and staggering, and the feet were moved clumsily. In June there was twitching of the face and jerking during sleep. In August, station was extremely unsteady and tremor in the right upper extremity was marked.

The patient presented himself at the hospital for the last time on December 30, 1907. Subsequently I learned, on inquiry, that he had died within an hour on September 3, 1908, in an apoplectic attack, in all probability due to rupture of a rigid cerebral vessel. His eyesight had grown gradually worse, but the pricking and stinging sensations in the face were absent during the last six months of life. His daughter, when spoken to about the tremor, said that to her knowledge there had been some shaking of the hands at times for many years.

We thus have a case of locomotor ataxia in an elderly man, exposed in his occupation to the elements and without a history of syphilis, in the course of which symptoms of paralysis agitans appeared and went on to classic development. As already stated,

there appears to be no reason to believe that the association was other than accidental.

The first reference to the association of locomotor ataxia and paralysis agitans that I have been able to find is contained in a graduation thesis by Anton Heimann[2] on paralysis agitans. Herein is contained the report of a case occurring in a man, aged fifty-two years, with symptoms of locomotor ataxia, who presented tremor of the lower lip and of the right upper extremity on excitement; and of a second case occurring in a man, aged sixty-six years, with some of the symptoms of both locomotor ataxia and paralysis agitans. S. Placzek[3] reports a case of locomotor ataxia in a man, aged fifty-two years, in the course of which symptoms of paralysis agitans developed. Weil[4] reports the case of a woman presenting symptoms of both locomotor ataxia and paralysis agitans. At a meeting of the Aerztlicher Verein zu Hamburg, Hess[5] exhibited a woman, aged sixty years, presenting symptoms of both diseases.

Under the title of tromoparalysis tabioformis, J. U. A. Wertheim-Salomonson[6] reports a similar association in a man, aged fifty-six years, who at one time had suffered from a transitory left hemi-paresis and at another time from loss of consciousness without subsequent palsy. There was some weakness of both extremities on the right side, and memory and intelligence were enfeebled. The disorder was looked upon not as a simple combination of diseases, but as a distinct and separate affection, possibly due to posterior column disease of unusual pathogenesis—perivascular insular sclerosis. Seiffer[7] reports again the cases previously placed on record by Placzek and Weil. J. H. W. Rhein[8] reports the case of a man, aged fifty-seven years, presenting, in addition to symptoms of locomotor ataxia, fine rhythmic tremor of the hands "resembling in a striking manner that seen in Parkinson's disease." The tremor was considered an unusual symptom of locomotor ataxia rather than an actual manifestation of paralysis agitans. G. Kodderman[9] reports the case of a woman, aged sixty-two years, presenting symptoms of both locomotor ataxia and paralysis agitans. F. Penzoldt and R. Stintzing[10] state that temor, and even a well-marked clinical picture of paralysis agitans, occurs in cases of locomotor ataxia, and he refers to a case of such association. Z. Bychowski[11] reports the case of a woman, aged sixty-five years, presenting the muscular rigidity or hypertonia of paralysis agitans in the upper extremities and the face, in conjunction with the

[2] Berliu, 1888.
[3] Deut. med. Woch., July 7, 1892, p. 632.
[4] Neurolog. Centralbl., 1898, xvii, 713.
[5] Ibid., 1900, xix, 581.
[6] Ibid., 1900, xix, 741.
[7] Ibid., 1900, xix, 1119.
[8] Jour. Amer. Med. Assoc., December 27, 1902.
[9] Inaugural Dissertation, Jena, 1903.
[10] Handbuch der Therapie innerer Krankheiten, 1903, v: Handbuch der Therapie der Erkrankungen des Nervensystems, p. 698.
[11] Neurolog. Centralbl., 1904, xxiii, 786.

muscular relaxation or hypotonia of locomotor ataxia in the lower extremities, together with other symptoms of both diseases. A sister that had died was said to have presented a similar symptom complex. L. Bruns[12] reports the case of a man, aged sixty-four years, exhibiting a combination of symptoms of both locomotor ataxia and paralysis agitans. H. Eichhorst[13] reports a fatal case of locomotor ataxia in a man in whom the tremor of paralysis agitans developed a short while before death. Postmortem examination disclosed the anatomical lesions of locomotor ataxia.

CONCLUSIONS. From the foregoing facts and considerations it may be concluded that locomotor ataxia and paralysis agitans have little or nothing in common, etiologically, anatomico-pathologically, or symptomatologically. Their associated occurrence in a given case, therefore, must be looked upon as a mere coincidence. While by no means rare, neither disease is common, and their association is correspondingly infrequent. Only a small number of cases have been placed on record in which both diseases were present in the same patient.

A CASE OF CEREBRAL TUMOR PRESENTING A VERY UNUSUAL CLINICAL COURSE.[1]

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THE following case seems to be one of unusual interest from the very peculiar, almost rhythmical, course that it pursued. Mrs. S., aged forty-six years, a married woman, and the mother of three healthy children, was first seen in May, 1906, complaining of severe headaches and constipation. The headaches had occurred during most of her adult life, and were nearly always associated with the menstrual period. While they were on she was scarcely able to speak, and often was sick at the stomach. Except for these headaches and the chronic constipation, she was and always had been well and full of healthy activity.

Her father died at an advanced age of cerebral hemorrhage; her mother at seventy years of a protracted diarrhœa. One brother

12 Neurolog. Centralbl., 1904, xxiii, 978.

13 Pathologie und Therapie der Nervenkrankheiten, Berlin and Vienna, 1907, p. 340.

1 Read at a meeting of the Association of American Physicians, Washington, D. C., May 11 and 12, 1909.

died of angina pectoris, and was found to have marked sclerosis of the coronary and cerebral arteries.

At the first consultation, in May, 1906 (about two years before her death), she was a healthy looking woman, and, as stated above, only complained of headaches and of chronic constipation. She was given a palliative and a cascara mixture to take regularly.

On June 6, 1906, it was noted that she looked "run down," spoke in a scanning manner, and wrote with difficulty, often leaving out words. The headaches were less severe. She was sent away for a long change. In October she was "looking fairly well," and had had no headache for a month. Bowels were regular with the cascara mixture. On November 6, for some days she had had occasional numbness and tingling in the left arm and hand. Right grip was sixty, and left fifty. There was no real numbness. The knee-jerks were normal. On December 10 it was noted that the patient had slight headache and was feeling dull, had difficulty in finding the right words, and "often says and writes wrong ones." Bowels were regular with medicine, and all other functions seemed to be normal. There had been no menstruation since last May. On May 15, 1907, the following note was made: "She is feeling depressed and easily worried, and has frequent headaches. Her weight keeps up. The hemoglobin registers 80 per cent. There has been no menstruation since last May."

She went away for a long change, and on returning the following note was made: "September 20, 1907.—Back from a long holiday, and looks fairly well, but faded. Hemoglobin, 80 per cent. If her bowels do not move she has severe headaches. Still has some hesitation in speech, and tends to use wrong words. Scarcely ever reads, and seldom writes letters, and if she does, may write wrong words. Sleeps well, and digestion is normal. The knee-jerks are equal and sluggish."

In October, 1907, she "had a dizzy turn. Had been sitting in the sun, and then while walking toward the house she sank down, but did not become unconscious." A few days later she had a similar turn and fell and hurt her head. Dr. McPhedran saw her with me, and we sent her into a private hospital for complete rest and observation. For about a month after entering here she seemed about the same, frequently complaining of headache and suffering from severe constipation, which drugs seemed almost powerless to relieve. Upon November 3, 1907, she seemed drowsy, although bright and cheerful when roused. The next day there was some diarrhœa—a most uncommon symptom for her—and later in the day she vomited. The next day the following note was made: "She vomited once during the night. No more diarrhœa. Since this morning she seems drowsy and now (4 P.M.), can scarcely be roused. Seems as if intoxicated, and if addressed smiles feebly, but will not put out her tongue or turn in bed. Resists arms being

moved. There is retention of urine, and this, on being drawn off with a catheter, shows no abnormality. There is no squint and the pupils are normal." Late that evening Dr. J. M. MacCallum examined the eyes and reported that they were practically normal, the veins being perhaps a little full, and slight haziness of the left fundus. By now she was absolutely comatose, with loud stertorous breathing, and fixed pupils, and it seemed as if she must die before morning. She was evidently suffering from acute cerebral compression of some sort. Next day, however, she was no worse. A lumbar puncture was done, and the fluid seemed under some increased pressure. The cerebrospinal fluid showed no chemical or physical abnormality upon most careful examination. No choline was present.

November 7. "She is rather brighter, and feels tickling of the soles of the feet. Pupils are unequal, the left being large and the right small. They do not react to light. Marked ankle clonus present in right foot. Both knee-jerks are exaggerated. A spastic athetoic condition is present in the whole body, but especially on the left side."

November 8: "She was markedly better, being quite intelligent, and recognizes people. Answers questions quickly and says that her tea 'is hot and too sweet.' The spastic condition of the muscles is gone, and the plantar reflexes are flexor in type. Pupils are equal and react normally to light. She still requires the catheter."

On December 9 it was noted that "she is quite bright and speaks better than she has done for months. No headache." She steadily improved, and on December 13 remarked that "it was a pleasure to eat and to sleep." There was no headache. Bowels were moving naturally, which they had not done for years. Urination was normal and the reflexes were also normal.

December 24, 1907. "Doing well, but there is some want of coördination in the movements of the right hand and arm. The grip is strong, but when she feeds herself she is apt to spill things, and therefore tends to use chiefly the left hand. Is easily tired."

In January she had a similar attack of what one might call cerebral compression, in which she became very dull and difficult to rouse. The right side of the body was distinctly weak, and the right pupil was larger than the left. There was slight ankle clonus on the right side and marked on the left. She had some vomiting. She got over this attack more easily than the first one, and on February 12 returned home apparently as well as when she entered the hospital three months before.

On February 15 it was noted that "she seemed well last night and slept well until 4 A.M., then became restless and soon vomited her evening meal unchanged. Vomited twice more during the morning, became drowsy, and by 3 P.M. was quite unconscious, lying on the back with head turned toward the left and the limbs

somewhat spastic. Face pale, temperature normal, and pulse sixty. Pupils small, equal, and react to light. Ankle clonus marked in *left* leg and slightly present in right. Planter reflex active and extensor in type on both sides." By 10 P.M. the pulse was 108, temperature 99.5°, and the systolic blood pressure was 210 mm. (it had frequently been measured between the attacks and never was found to be above 125 mm.). During the whole of next day she seemed to be at death's door with acute cerebral compression; but the next morning it was noted that the blood pressure had fallen to 120 mm., and by evening she was slightly conscious. The next day she was back to a condition normal for her between the attacks.

From then until March 14 she seemed to improve and was getting about the house; reflexes, pupils, etc., remained normal. The blood pressure on frequent measurements never rose above 130 mm. On March 14, 1907, she "woke at 5 A.M. feeling nauseated, and had some headache. Was dull all day, but the blood pressure did not rise above 120 mm., and by 10 P.M. she was feeling better and was sitting up in bed." Next day she seemed as usual, except that there was slight ankle clonus on the left side, and the planter reflexes were both extensor in type.

On April 8 this note occurs: "Was particularly well yesterday and walked downstairs and was speaking well. At midnight seemed restless, and then slept badly, and passed water involuntarily. This morning she seems dull, but there has been no vomiting. Is quite intelligent and answers questions clearly. There is some spasticity, best marked upon the right side. Ankle clonus and Babinski's sign well marked upon both sides." By night she was "much worse, and the spasticity almost amounts to convulsions, passing over the body in long waves. Systolic blood pressure 165 mm., but is hard to measure owing to the convulsive waves."

April 9, 9 A.M. "Had a bad night and is now quite unconscious. Spasticity very marked, but not in waves like yesterday. Pupils equal and small. Urine involuntary. Systolic blood pressure 150 mm."

From that time on the coma deepened, and the breathing got slower and slower, and she became livid. The blood pressure fell to 120 mm., but without the usual cerebral improvement. The pupils became very unequal, the left being large and the right pin-point, and later they became equally dilated. The breathing became slower and slower and then stopped altogether, the heart continuing to beat for several minutes after the last breath.

The report of the postmortem examination performed some sixteen hours after death by Professor J. J. Mackenzie is as follows:

On removing the clavarium the dura mater was found to be tense. The sinuses were filled with soft clot. On stripping the dura from the cerebrum it was found to be adherent over a large tumour mass which lay on and in the left cerebral hemisphere (Figs. 1 and 2). There were a few small flat white tumor nodules on the inner side of

the posterior portion of the dura over the left hemisphere and falx
cerebri.   There was a very large tumor situated between the ten-
torium and the occipital lobe on the left side; this was attached firmly
to the tentorium and easily lifted away from the brain substance.
There was considerable œdema of the pia-arachnoid; the vessels of
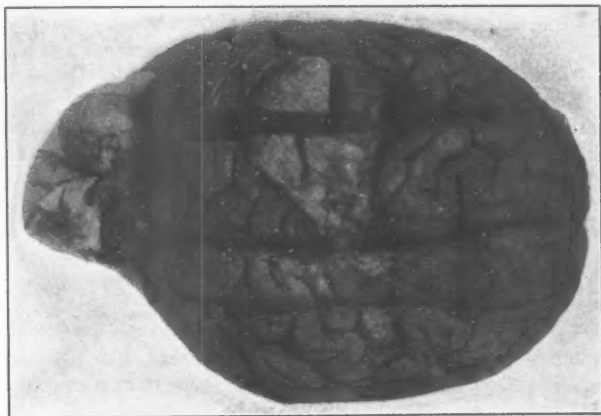
Fig. 1.—View of the tumor from above.
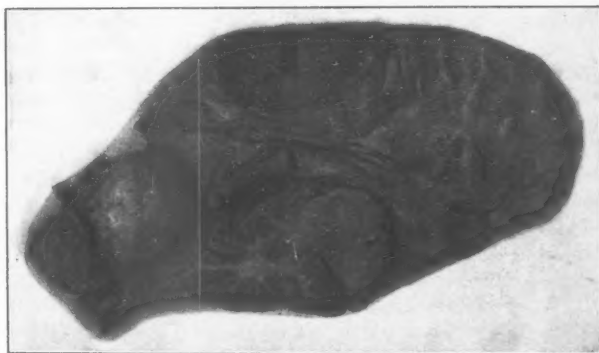
Fig. 2.—Section of the tumor.

the left side were markedly congested and the convolutions were
flattened.   There was some dilatation of the lateral ventricles.
    The large tumor attached to the tentorium is roughly egg-shaped
in outline and measures 6 cm. in its long axis.   The larger end is
4.3 cm. in diameter; the smaller, 4.3 cm. in diameter.   On section
the tumor mass is very hard and fibrous, with a glistening cut surface.
It lies upon and is attached to the tentorium on the left side, com-

pressing and pushing upward the occipital lobes, compressing especially the gyrus lingualis, gyrus cuneus, and a portion of the lateral occipital gyri. The smaller tumor masses are attached to the dura and the falx cerebri, the largest measuring 0.7 cm. in diameter, all of them quite flat, 1 to 2 mm. in thickness. They do not in any way compress the brain substance, are white in color, and of the same consistency as the large mass which is attached to the tentorium. The second large tumor, which lies upon the left hemisphere, is firmly attached to the dura. It does not infiltrate the brain, but compresses the convolutions beneath it. It is loosely adherent to the pia-arachnoid, but can be dissected off. It measures 5 cm. in its anteroposterior diameter, 4 cm. lateral diameter, and is 2 cm. in thickness. It is quite soft and of a pinkish color, with here and there areas of a deeper hemorrhagic tint, and showing throughout its substance yellow areas of fatty degeneration. In front it lies upon the gyrus centralis posterior, compressing it and pushing it forward and to the left. It also compresses most of the lobulus parietalis superior, and the lobulus parietalis inferior, which appears as a narrow band between the tumor and the marginal gyrus. The inner margin of the tumor is 2.2 cm. from the longitudinal fissure. On section the gray and white matter of the brain beneath the tumor, although distorted by the compression, do not show any gross evidence of degeneration.

HISTOLOGY. The large hard tumor attached to the tentorium is exceedingly fibrous. Stained by the van Giessen method, it shows masses of red staining fibres. Between them are many cells with dark rod-like nuclei mixed with a small number of cells with large oval vesicular nuclei and faintly staining chromatin. In some areas these latter cells are present in larger numbers. The connective tissue fibers run in bundles in all directions. The vessels are well formed and are not numerous. Corpora amylacea are present but are not numerous. Mitotic figures are not seen. The soft tumor upon the surface of the parietal lobe is very cellular. The cells are somewhat smaller than the large cells of the other tumor. They are in the form of short spindles with oval vesicular nuclei. They are arranged in strands and bundles which are sometimes definitely related to the bloodvessels, and sometimes seem to run independently of them. There is very little fibre formation and the whole tumor is distinctly loose in texture. The vessels are numerous and thin walled. Mitoses are rare in this tumor also. Occasionally one finds multinucleated cells.

The histological characters of these tumors seem to point without doubt to their being endotheliomatic, arising from the dura. The large soft tumor is of the ordinary cellular type of endothelioma; the large hard tumor and the small metastatic nodules in the neighborhood would fall into the class of so-called fibro-endotheliomas. There seems no doubt that they are similar in orign, the large tumor

attached to the tentorium being probably the oldest, the soft tumor over the parietal region being the most recent. In connection with the clinical symptoms the loose texture of this latter nodule and the rich vascular supply is of great significance.

RESUME. The patient for the greater part of her life had suffered from severe headaches, with some aphasia during the paroxysms. At the menopause the headaches rather lessened in acuteness, but the aphasia tended to last slightly, so that she would hesitate in speech and occasionally use the wrong words, both in speaking and writing. Next, she got an attack of what seemed like acute cerebral compression without localizing symptoms. This passed off, and she was as well as before for nearly ten weeks. Then the compression recurred, and again passed off, but recurred at intervals of a month, until the fifth proved fatal. Between the attacks she would seem nearly well, and on the day before the fatal one, spoke unusually well and walked down stairs.

The case during life seemed to us to be probably one of some sort of cyst, which periodically filled and after producing almost fatal compression emptied itself in some way. The postmortem findings were a surprise, and even yet it is difficult to explain the case. The spasticity from which she suffered during the acute attacks was nearly always most marked upon the left side, that is on the same side as the tumors were. This was probably due to cerebellar irritation from the pressure of the posterior tumor. The almost constant monthly recurrence of the acute compression is interesting. It suggests the possibility of the increased pressure being in some way connected with the menstrual function, although this had ceased over a year before. She always had had bad headaches at that time, and they continued after the flow had ceased, and the same cerebral congestion now occurring in a brain the seat of tumors had in some way produced the severe and finally fatal compression. It seems, then, that the case was one of almost symptomless brain tumor, complicated by periodic attacks of cerebral congestion, this congestion being a relic of the menstrual periods.

Vasomotor disturbances are very common at the menstrual epoch, and often persist after the menopause, as in a case recently come across in which a woman had suffered most of her life from epistaxis during the menstrual period, and after the menopause this bleeding persisted and was still occurring at the age of sixty.

The blood pressure always was very high during an acute attack. We always assumed that this was due to the cerebral compression, but Professor Adami suggested that the increased blood pressure might have been due to some unexplained cause, but very likely related to the menstrual period, and that, by producing great distention of the vascular tumors, might have been the cause of the acute cerebral compression. The anterior tumor being very vascular might well lend itself to such distention.

REVIEWS.

A SYSTEM OF MEDICINE. By Many Writers. Edited by SIR
CLIFFORD ALLBUTT, K.C.B., Regius Professor of Physic in the
University of Cambridge; and HUMPHRY DAVY ROLLESTON,
M.D., Senior Physician to St. George's Hospital, London. Vol.
IV, Part I, pp. 764; Part II, pp. 566. London: Macmillan & Co.,
Ltd., 1908.

VOLUME IV of the second edition of Allbutt's *System of Medicine*
is issued in two parts, of which Part I is devoted to diseases of the
liver, gall-bladder, bile ducts, pancreas, ductless glands, and kidneys,
and such other disorders as infantilism, obesity, adiposis dolorosa,
and œdema, while Part II comprises a discussion of diseases of the
nose, pharynx, larynx, and ear. Both parts contain much new
matter, as well as revision and expansion of matter published in
the first edition. Dr. Arthur Keith contributes new articles on
the anatomy of the liver and on hepatoptosis. Dr. William Hunter
contributes a new article on delayed chloroform poisoning, and has
considerably revised his article on jaundice. He is now disposed
to view all jaundice as obstructive, the one form resulting from
obvious mechanical obstruction independent of changes in the
blood or bile (simple obstructive jaundice), the other being depend-
ent upon changes in the bile and blood, the actual cause of the
obstruction being increased viscidity of bile consequent on intra-
hepatic catarrh (toxemic obstructive jaundice); this comprises the
cases heretofore referred to as hematogenous jaundice. The facts in
support of this undoubtedly correct contention are well marshalled,
and are quite convincing; but perhaps they are not applicable to
that unusual and ill-understood form of jaundice known as family
jaundice. Another notable improvement is in the discussion of the
cirrhoses of the liver. In the original edition, Dr. Hawkins described
three types of cirrhosis—the alcoholic, the malarial, and the syphilitic
(a very poor classification); in the new edition two types of cirrhosis
are described—portal cirrhosis, by Dr. Hawkins, and biliary cirrhosis,
by Dr. Morley Fletcher. Dr. Hawkins, in an excellent discussion
of portal cirrhosis, points out the undoubted etiological significance
of alcohol, and suggests that the action of alcohol is indirect rather
than direct—favoring perhaps the activity of some other poison
as yet undetermined; but he also points out the fact that cases of

this type of cirrhosis undoubtedly occur, in children especially, but also in adults, in which alcoholism plays no part. Portal cirrhosis then appears to be definitely toxic in nature, and alcohol, although the commonest, is by no means the only etiological factor. Mr. Mayo Robson contributes the articles on diseases of the gall-bladder and biliary ducts; they are such as one expects from a universally recognized authority. The valuable article on diseases of the pancreas, contributed to the first edition of the work by Dr. Fitz, has been replaced in the new edition by articles by Dr. W. C. Bosanquet and Dr. G. Newton Pitt. Dr. Bosanquet divides the causes of chronic pancreatitis into infective, toxic, and degenerative, and doubtfully adds a fourth, mechanical cause; he believes that the disorder is frequently due to the abuse of alcohol, and that it is often associated with fibrosis of the liver; major etiological significance apparently is not attributed to disease of the gall-bladder and biliary ducts. Mild grades of the disease (commonly encountered at the necropsy) are believed to run their course without noteworthy symptoms.

The discussion of diseases of the ductless glands has been much amplified, and now contains about all that is really known of the subject. Dr. Hector Mackenzie contributes the articles on cretinism and exophthalmic goitre; Dr. George R. Murray, those on myxœdema and lymphadenoma; Dr. E. F. Trevelyan, that on akromegaly; Dr. H. D. Rolleston, those on diseases of the adrenals and the spleen; and Dr. John Thomson, that on status lymphaticus. It is interesting to observe that in the treatment of myxœdema Dr. Murray prefers the liquid preparation of the thyroid, liquor thyroidei, which he directs should be freshly prepared once a fortnight. In the intractable headache of akromegaly Dr. Trevelyan suggests the wisdom of trephining.

Professor J. Rose Bradford contributes two articles on diseases of the kidney—the one on the general pathology of the renal functions, the other on nephritis, which replaces an article on the same subject by Dr. Dickinson in the first edition. Dr. Bradford's two articles are really excellent, and well repay careful perusal, particularly, perhaps, if one may choose from such general excellence, his discussion of so-called physiological albuminuria, uremia, the cardiovascular changes of nephritis, etc.; however, the real cause of the uremic manifestations and of the cardiovascular changes is still elusive. Professor A. Macalister contributes a short article on nephroptosis, and Mr. Henry Morris articles on the other diseases of the kidneys and the ureters.

Part II of Volume IV as now issued may be said to be a complete manual or text-book of diseases of the nose, pharynx, larynx, and ear. It is somewhat unusual to include in a *System of Medicine* such a thorough and complete discussion of subjects commonly relegated to the so-called specialties, but the excellence of the result amply

justifies the editors in their decision; and assuredly the volume will be read with interest and profit by many general practitioners as well as specialists.

Of the two parts, really two volumes, one may say that they contain a good deal of new matter as well as revision of older matter —all of which assuredly represents the statements and opinions of authorities well qualified to give expression thereto. The books are worthy members of their family, and may be heartily recommended.   A. K.

SURGERY, ITS PRINCIPLES AND PRACTICE. By Various Authors. Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Emeritus Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia; and JOHN CHALMERS DA COSTA, M.D., Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Vol. IV; pp. 1194; 582 illustrations. Philadelphia and London: W. B. Saunders Co., 1908.

THE second and third volumes of this system of Surgery were reviewed in these pages some time ago. The contents of Volume IV include: Hernia, by William B. Coley; surgery of the anus and rectum, by Robert Abbe; examination of the urine in relation to surgical measures, by David L. Edsall; surgery of the kidney, ureter, and suprarenal gland, by Joseph Ransohoff; surgery of the bladder, by Bransford Lewis; stone in the bladder, by Arthur Tracey Cabot; surgery of the prostate, by Hugh H. Young; of the penis and urethra, by Orville Horwitz; of the scrotum, testicle, spermatic cord, and seminal vesicles, by Arthur Dean Bevan; of the intestines, by Weller Van Hook and Allen B. Kanavel; surgery of the appendix vermiformis, by John B. Murphy; of the ear, by Edward B. Dench; of the eye, by George E. de Schweinitz; military surgery, by Surgeon-General Robert M. O'Reilly, U.S.A.; naval surgery, by Surgeon-General P. M. Rixey, U.S.N.; tropical surgery, by Major Walter D. McCaw, U.S.A.; and the influence of race, sex, and age in surgical affections, by William L. Rodman.

This curious collocation of articles, by which the eye and the ear are buried among the genitalia, and by which the appendix and intestines are separated from abdominal surgery by the surgery of the urinary tract, is probably due more to the dilatoriness of the authors of these misplaced articles than to any preconceived notion of the editors that the present arrangement is the best. Few of the articles in this volume are either systematic or scholarly; in many instances they appear to have been written hurriedly and with negligence, it seeming doubtful in a few cases whether the

writers have even taken the trouble to re-read their papers when once written, or when written for them even to peruse them in person. From this criticism, however, must be excepted the articles contributed by Edsall, Cabot, Young, Dench, de Schweinitz, O'Reilly, Rixey, McCaw, and Rodman, all of which give evidence of a conscientious endeavor to present the subjects treated in as comprehensive and thorough a manner as the limits assigned permit.

Coley opens the volume with a rambling and disconnected account of hernia; no student who has not studied the subject elsewhere need expect to profit by the present article unless he carefully revises and reëdits it so as to make it present some form of logical and orderly sequence. The illustrations are good as well as instructive. Abbe's article on the rectum and anus is not particularly noteworthy: we think his position in regard to the indications for iliac colotomy for imperforate rectum not sufficiently supported by facts; following Kelsey, he asserts the rarity, which is becoming recognized, of syphilitic strictures and ulcers of the rectum; no adequate account of the combined abdomminal and perineal route for excision of rectal carcinoma is given. Edsall's article on the examination of the urine in surgery is decidely pessimistic, announcing that few tests give any more valuable information than is obtained by the routine examination for albumin, casts, etc. Of Cammidge's test he says: "The clinical results with it have been entirely unreliable in the hands of most skilful men. I believe that it has no clinical importance, but this is not yet fully settled."

Cabot gives an admirable clinical description of stone in the bladder, with interesting historical sketches of litholapaxy and lithotomy. He draws well-deserved attention to the former operation, which is too much neglected in this country. Young discusses other affections besides hypertrophy of the prostate, the most important of which is chronic prostatitis with its varying symptoms; he questions the role of inflammation in the production of hypertrophy, stating that it is rather a neoplastic change; perhaps to call it an adenomatoid condition would be safer.

Murphy's article on appendicitis appears to have been written several years ago, and though revised in some portions, in others is not brought up to date—notably in the account of the pathogenesis of the disease. Many of the illustrations are good, but those of the pathological lesions in the appendix are absolutely disgraceful. There is scarcely sufficient appreciation of the seriousness of the cases of those patients who have reached what Murphy calls the third stage of the disease, that is, the period immediately succeeding the subsidence of diffuse peritonitis. While a number of these patients may be assured of convalescence without immediate operation, yet in a large proportion there is only a lull before the storm of general peritonitis breaks again, owing to leakage through limiting adhesions. When patients, seen first while desperately

ill with diffuse peritonitis, have been brought successfully through to this stage by perseverance in the "Ochsner treatment" of abstinence, it is a very difficult thing to decide the most propitious time for operation; and it is to be regretted that so experienced a surgeon as Murphy evades the issue by passing over this question in silence.

In regard to military surgery, it is well pointed out by General O'Reilly that what the ordinary surgeon lacks is not so much a knowledge of how to treat the wounded in battle, but an understanding of the organization and administration of medical affairs in both war and peace; and he urges the National Guard surgeons to avail themselves more freely of the Army Medical School. Dr. Rixey's account of naval surgery is extremely interesting, describing as it does in detail the arrangements for treating the wounded during a battle and subsequently, and the construction and equipment of hospital ships.

The two most interesting subjects in tropical surgery discussed by Major McCaw are appendicostomy for amœbic dysentery, and the treatment of hepatic abscess. He does not recommend appendicostomy as a last resort, nor in patients whose recovery is improbable, on account of the extent of the lesions in the colon; but he urges it in those cases in which improvement under rectal irrigation occurs up to a certain point and then stops, showing that the disease is still in a curable stage, but that irrigation from below is inefficient. For the diagnosis of hepatic abscess he prefers exploratory laparotomy to the trocar. He describes only the abdominal and the subpleural thoracic routes for evacuating the abscess, but does not write as if he had much personal experience with operation; and his neglect to discuss the transpleural route is somewhat remarkable.

The present volume hardly maintains the standard set by those which preceded it; and it is to be hoped that the contributors to the final volume, the publication of which in the near future is announced, have made more successful efforts to expound intelligibly the principles of surgery and to further its art.

<div align="right">A. P. C. A.</div>

DISEASES OF THE DIGESTIVE CANAL. By PAUL COHNHEIM, M.D., Specialist in Diseases of the Stomach and Intestines in Berlin. From the second German edition, edited and translated by DUDLEY FULTON, M.D. Philadelphia and London: J. B. Lippincott Co., 1909.

THIS is a refreshing book written obviously from material and information gathered in actual practice by the author himself. It is not burdened with references from the literature, but the author is

familiar with the important contributions to diseases of the digestive tract. The presentation is admirably clear. There is no hedging, nor can there be any doubt as to what the author means. Certain defects are apparent in the plan of the book. Of these, the most serious are: A persistent dogmatism, many statements being made in a positive manner for which no adequate proof is offered, and with which not all physicians working in this line would be likely to agree. Second, there is the omission of many things which it is to be presumed Dr. Cohnheim regards as useless, but which have authority to support them, and therefore should have been offered to the reader for consideration. A brief but admirable section upon anamesis opens the book. The description of the physical examination cannot be regarded as complete so far as the methods described are concerned. The subject of auscultation. which is one of the most important and in the hands of an expert reveals almost as much information about the abdomen as does the auscultation of the thorax, is discarded in three lines. The subject of the laboratory tests are given considerable space, and they are described sufficiently for the general practitioner. The diagnosis of chronic gastritis is apparently to be made provisionally in all chronic cases in which ulcer, carcinoma, or dilatation of the stomach can be excluded. There is a diagram of the evolution of the disease showing how in some cases, it leads first to hyperacid gastritis with subsequent subacid gastritis, and in others to subacid gastritis from the beginning. This corresponds more to the author's theory than to anything found in actual practice. The discussion of the diagnosis of ulcer is entirely inadequate. This may be judged from the statement that "epigastralgia occurring at a definite time after eating, is the most positive symptom of gastric ulcer." Percussion tenderness is entirely overlooked, and the value of occult blood minimized. Surgical treatment is restricted to perforations, persistent hemorrhage. and for the relief of complications. There is apparently some confusion between dilatation of the stomach and retention of the stomach contents, and although the diagnosis is not carefully described, it is said to be very easy. The subject of gastroptosis is rather cursorily treated. The treatment is largely limited, apparently, to mechanical means of support, and there is no discussion of the surgical treatment of the disease. The author is quite modern and gives a long paragraph on suggestive treatment for the condition called nervous dyspepsia. He speaks of this again in nervous or reflex vomiting. Nervous conditions can be recognized by the fact that actual pain is never a symptom. The sections on diseases of the intestines is one of the best brief descriptions of this subject that has as yet been made. As in the section on the stomach, the physical examination of the abdomen has been neglected. Typhlitis is resurrected, classified, and described. There are excellent chapters on diarrhœa and constipation. It seems doubtful if many physicians would be willing

to diagnosticate with assurance from the brief account of the symptoms and physical signs described by the author. The appendix contains one of those unfortunate tables designed for the use of the ill-equipped physician, who does not care to examine his patient thoroughly. There are a variety of diets which have the advantage of being quantified as well as indicating what foods are to be taken, and a sort of quiz compend at the end which has the extraordinary title of Clinical A, B, C of the Most Important Disturbances of the Digestive Tract.

The book is supplied with a number of prescriptions. One must remark the frequency with which belladonna or some of its preparations appears in them and for what a diversity of conditions this drug is used. It must also be noted with general regret that a very large number of proprietary preparations are recommended. There are a number of illustrations, many of them including portraits of the author. As these actually show him performing certain examinations, they may be regarded as of advantage.   J. S.

A TEXT-BOOK ON EMBRYOLOGY. By FREDERICK RANDOLPH BAILEY, A.M., M.D., and ADAM MARION MILLER, A.M. New York: William Wood & Co., 1909.

EMBRYOLOGY as a science is so vast and so constantly being modified by new discoveries that a clear, concise, and up-to-date treatise on the subject is of great value, not only to the scientist, but the student as well. The forelying text-book brings the subject thoroughly up to date. As is general in such works, the book is divided into two parts—one on general development, and the other on organogenesis. In the former are presented the preliminary steps in development, including the structure of the cell and cell proliferation, oögenesis and spermatogenesis, maturation, fertilization, cleavage, formation of the germ layers, the foetal membranes, and the development of the external form of the body. In dealing with these subjects the authors have taken great pains to avoid unnecessary elaboration, and present the subject matter in as succinct a form as possible. Special attention is paid to the various theories with regard to the processes involved and the physiological significance of the processes themselves. A very valuable feature of the work consists of the practical suggestions offered, not only in the matter of technique, but also how, when, and where to procure and prepare material for practical work. The second part of the work on organogenesis takes up the development of the various organ systems at length, somewhat too copiously, perhaps, for the needs of the average medical student. but with a clarity of diction and careful handling of the subject matter which holds the attention of the reader at all times. Students

of medicine and practitioners will greatly appreciate the paragraphs at the end of each chapter on the anomalies occurring in the different organs under discussion.   This feature alone will recommend the work as particularly valuable as a text-book for medical men.   The illustrations are numerous, well chosen, and well made, and contain a number of photogravures showing actual conditions.   The last chapter of the work on teratogenesis materially aids in explaining the causes and method of development of those strange conditions so puzzling to the average practitioner of medicine.

<div align="right">H. H. C.</div>

DIE WURMFORTSATZ-ENTZUNDUNG: EINE PATHOLOGISCH-HISTO-
    LOGISCHE UND PATHOGENETISCHE STUDIE.   (APPENDICITIS: A
    PATHOLOGICO-HISTOLOGICAL AND PATHOGENETIC STUDY).   By
    L. ASCHOFF, Professor of General Pathology and Pathological
    Anatomy in Freiburg i. B., Germany.   Pp. 114; 18 lithographic
    plates and 22 figures in the text.   Jena: Gustav Fischer, 1908.

THIS monograph, the result of seven years' work, is based on a study of one thousand appendices removed at operation by the author's surgical colleagues, Rotter, Enderlen, Küttner, Kraske, and Krönig.   Six hundred of these appendices have been studied with the utmost precision.   The preparation of the volume was undertaken for two reasons: (1) Because so many papers and discussions on appendicitis show misinformation of the pathology and ignorance of the normal anatomy of the appendix; (2) because these later studies serve to confirm the conclusions published by Aschoff four years ago.   In the limits allotted to this review it will be impossible to do more than very briefly outline the author's views, which differ in many points very materially from those usually taught.

Aschoff holds that all cases of appendicitis are similar, in that the same pathological stages occur in each.   The first lesion ("Primärinfekt") in his experience has *never* been a catarrhal inflammation of the appendix: *always* he has found a localized inflammatory reaction in the depths of one of the crypts or recesses of the lumen of the appendix.   This Primärinfekt, which is more often multiple than solitary, does not consist in an exfoliation of epithelium in the nature of an erosion or ulcer; it is a round-cell infiltration of neutrophiles under the epithelium of the crypt; and if the epithelium itself is altered at all, its place is taken by a plug of leukocytes and fibrin. The lymphatic follicles are not involved; but from the focus of primary infection the inflammatory reaction quickly spreads along the lymph channels to the serous coat, which may be widely inflamed before any extension in the mucosa occurs.   This second or

phlegmonous stage may pass on into the formation of miliary intramural abscesses; these may perforate either into the lumen of the appendix or into the peritoneal cavity—miliary perforations. To this stage succeeds that of ulceration, which he has never seen unless preceded by the phlegmonous. The ulceration of the mucosa may result in perforation (macroscopic perforations), or in gangrene of the appendicular wall, owing to circulatory disturbances.

The pathogenesis of appendicitis consists in the localization of the primary focus in the distal end of the appendix, largely owing to stagnation of the contents of the appendix from the physiological kink in the middle third of the organ. Aschoff supports the enterogenous theory of infection, as opposed to the hematogenous: yet he declares that the inflammation does not extend as a catarrh from the cecum, since this and the proximal part of the appendix almost invariably are uninflamed. He thinks coproliths harmless in an appendix, and is inclined to regard them rather as the result than the cause of inflammation; but they may be a cause of relapsing appendicitis by favoring infection through mechanical trauma. They frequently are produced by stagnation of the appendicular contents between two strictures left by previous inflammation. Usually the severest inflammation is distal to the concretion, not over it; and perforation on its distal side is by no means rare. His bacteriological studies have shown the presence of diplococci (streptococci) as the primary infection; he never found Gram-negative bacilli (colon bacilli) in the Primärinfekt.

He denies the existence of a chronic appendicitis without previous acute stages similar in all respects to those described. The symptoms may have been insignificant, but the histological picture of such cases of chronic appendicitis convinces him that the pathological process was the same in all. Likewise, appendicitis obliterans is regarded as the result of ulcerative changes secondary to a phlegmonous stage, itself inaugurated by the primary infection of one or more crypts. Hemorrhages and the so-called hemorrhagic appendicitis he regards as artefacts due to operation.

We should have been satisfied if the pathologist had concluded his manuscript at this point. The exposition of his views as to the treatment of appendicitis impels one to apply the proverb, "*Ne sutor ultra crepidam.*" His argument for medical treatment (opium), by which he hopes to prevent general peritonitis by favoring the formation of an abscess in all cases in which recovery without perforation does not occur, appears to consist in urging the inclusion in the statistics of recoveries after medical treatment of all those cases which present so insignificant symptoms as never hitherto to have been considered frank attacks of appendicitis. The only *raison d'être* which he admits for operative removal of the appendix is the prevention of other attacks, which he regards as nearly inevitable.   A. P. C. A.

SELF-CONTROL AND HOW TO SECURE IT. By DR. PAUL DUBOIS. New York: Funk & Wagnall Co., 1909.

DR. PAUL DUBOIS, of Berne, has followed his work on the psychic treatment of nervous disorders with one entitled *Self-control and How to Secure It*. This at least is the not very satisfactory title which represents the French *L'Education de Soi Même*. The former book was an apotheosis of commonplace notions gathered together without originality, except in some points in which the originality was of no advantage. The present is worse than this. It has a superficial aspect of depth; it says a good deal about the worship of the True, the Beautiful, and the Good; but it does not amount to anything in the final analysis. It is vague, windy, and verbose, and the reviewer's only satisfaction in reading it he got from the page on which the following occurs. The author scolds the doctors and says they set up minor truths as dogmas and have created a code of doctrines which are nothing but superficial appearances of truth and, upon being put to the test, do not work in practice. "These hopes, often announced to the public, have developed that pre-occupation about health which is the disease of the present generation." After which he writes another hundred or two pages in which he promotes pre-occupation of the most unreasonable kind. J. K. M.

A TEXT-BOOK OF THE DISEASES OF THE EAR FOR STUDENTS AND PRACTITIONERS. By PROFESSOR DR. ADAM POLITZER, Imperial-Royal Professor of Aural Therapeutics in the University of Vienna. Translated and edited by MILTON J. BALLIN, Ph.B., M.D., Assistant Surgeon, of the New York Ophthalmic and Aural Institute, and CLARENCE L. HELLER, M.D. Fifth edition. 337 illustrations. Philadelphia and New York: Lea & Febiger, 1909.

IT is always a pleasure to review a new edition of a book when it really presents the most recent advances in the subject of which it treats. Professor Politzer's book has long been the standard work, not only in Germany, but throughout the world, on diseases of the ear. The present edition maintains the high standard of its predecessors, and is, if possible, even more satisfactory in its contents and arrangement. As an instance of the thorough and careful revision which this edition shows, we may cite the handling of the subject of labyrinthine suppuration, for nothing in the recent progress of otolgy has been more marked than the late advances in the study and treatment of diseases of the labyrinth. In the fourth edition, Professor Politzer separated the consideration of the anatomy,

physiology, and pathology of the sound perceiving apparatus from that of the sound conducting apparatus, placing the section dealing with this subject toward the end of the book. In this edition, the section dealing with the anatomy and physiology of the sound perceiving apparatus is placed immediately after that dealing with the consideration of the anatomy and physiology of the sound conducting apparatus, and the section which deals with labyrinthine suppuration is placed where it properly belongs, in juxtaposition, midway between the section dealing with suppurative diseases of the middle ear and the section dealing with intracranial complications of otitic origin. The recent studies of von Stein, Barany, Alexander, and others are given the fullest consideration, so that the reader is put in possession of all the facts bearing upon this most important topic. The above is but one instance of many in which the book shows revision and improvement. It is not merely a reprint with a few additions, but a thorough, careful, and complete revision and rewriting of it. Although, of course, many of the old illustrations are retained, there are a number of additional engravings in the present volume. It may be said of this work that there is not one page nor one illustration which could be spared from its contents. From cover to cover it contains nothing but what is essential to the science of otology. There is no padding of any kind, and he who possesses it may feel that it contains the most complete, authoritative, and recent exposition of aural science obtainable. Much credit is due to Drs. Ballin and Heller, the translators, who have shown their ability to render thoroughly, not only the text, but the spirit of the author's work.   F. R. P.

NEW AND NON-OFFICIAL REMEDIES, 1909. Pp. 167. Chicago: Press of the American Medical Association, 1909.

THIS is a small volume that contains a description of more than 200 new and non-official remedial preparations approved by the Council on Pharmacy and Chemistry of the American Medical Association prior to January 1, 1909. For the most part the preparations are discussed alphabetically, but a classification has been adopted that permits an easy comparison of remedies of similar origin and properties; mixtures are relegated to an appendix, and mention is made of a number of non-proprietary remedies that have not been admitted to the Pharmocopœia. The book dealing as it does, with the important physical and chemical properties of the newer remedies, their processes of preparation, their action, uses, and dosage, is a welcome addition to the Pharmocopœia, and should prove of interest and value to practitioners and pharmacists.   A. K.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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Toxic Meteorism in Infectious Diseases.—KRÖNIG and KLOPSTOCK (*Deut. Archiv f. klin. Med.*, 1909, xcvi, 515) note the fact that in typhoid fever, pneumonia, puerperal sepsis, and erysipelas the presence of meteorism depends much less on the condition of the abdomen than on the degree of general infection. In the cases of pneumonia examined by them more than a half had this complication. It was much more common in the severe cases, and almost constant in alcoholics. Of the 27 fatal. cases, 81.5 per cent. developed marked meteorism. It was less frequent in the young than in the old. They believe it to be dependent on something specific in the infection, as it is very rarely present in scarlet fever, diphtheria, miliary tuberculosis, or cholera. As to the cause of the tympanites, increased intestinal fermentation associated with high temperature, as well as more limited passage of gases, are factors, but the important thing is apparently a lowered intestinal tone. This lowering of the tone of the smooth muscle of the intestine is analogous to the lowering of vascular tone which is present in pneumonia and is probably due to cerebral toxemia. Experiments on dogs and guinea-pigs, in which the intestine was inflated, resulted in more rapid and superficial respiration, together with a rise in diastolic and systolic blood pressure—the latter not marked in the guinea-pigs. The respiration is affected by pressure and fixation of the diaphragm, while blood pressure change depends on the added demands of the rapid breathing, increased pressure in the abdomen, and obstruction to the return flow of blood from the lower half of the body. In fatal instances respiratory failure precedes cardiac failure.

Abdominal Symptoms at the Onset of Pneumonia.—GLASERFELD (*Berlin. med. Woch.*, 1909, xlvi, 1451) reports two cases of pneumonia in which the onset simulated appendicitis. While the local physical signs of pneumonia are usually evident in such cases in from two to four days, in one of the instances here reported they did not appear until the ninth day. The atypical onset is most frequent with involvement of the lower lobes, but may occur when any lobe is attacked. Both of these cases terminated in lung abscess, and in 21 similar cases, Bennecke found 13 which had complications. The differential diagnosis is often most difficult, but Glaserfeld lays especial stress on the following points: The facial expression in pneumonia is less anxious when the sensitive part of the abdomen is palpated than in appendicitis. There is no facies abdominalis. The tongue is usually moist, and only slightly coated. The respirations are rapid. The abdominal spasm is not so localized as in early appendicitis. The abdominal tenderness is superficial. Deep palpation in the appendicular region does not give rise to any marked degree of pain. A most careful examination of the chest is of the first importance.

The Leukocytes and Differential Count in Acute Abdominal Infection.—As a result of blood examinations made just before operation in 184 cases of acute appendicitis, and in a number of other acute abdominal conditions, COONS and BRATTON (*New York Med. Jour.*, 1909, xc, 205) have devised a chart which forms a basis for the comparison of total leukocyte counts with the percentage of polynuclears, and which frequently throws light on both diagnosis and prognosis. They lay great emphasis on the polynuclear percentage as an indication of the presence and extent of sepsis. If the polynuclears are below 75 per cent. and a leukocytosis is present, one may look for an old, walled-off infection with perhaps an acute exacerbation. With the polynuclears ranging from 75 per cent. to 80 per cent., the blood evidence alone is rather indefinite. A polynuclear count of from 85 per cent. to 90 per cent. points to a severe infection, and in the presence of a leukocytosis indicates immediate operation. Especial stress is laid on a polynuclear count above 90 per cent. Twenty-five of the thirty-one cases with over 90 per cent. of polynuclears had some form of peritonitis. The worst prognosis was found in the cases of low leukocyte count with high polynuclear percentage. In these cases there was apparently little to be hoped for from operation.

The Intravenous Injection of Diphtheria Antitoxin.—Experimental evidence has shown that the amount of diphtheria antitoxin needed to neutralize a given amount of toxin depends largely on the time interval between the two injections. In order to obtain more rapid and effective action of diphtheria antitoxin, SCHREIBER (*Münch. med. Woch.*, 1909, lvi, 1591) has injected it intravenously instead of subcutaneously. Nineteen of twenty cases thus treated recovered. He used small doses of 2000 units at first, but later found that 6000 to 10,000 units produced no ill effects, even in children. With large doses the temperature fell more promptly than with the subcutaneous administration, and the general condition seemed to improve quicker. There was, however, no increase in the effect on the membrane itself.

The Opsonic Index in Typhoid-bacilli Carriers.—GAEHTGENS (*Deut. med. Woch.*, 1909, xxxv, 1337) states that in a series of 386 cases of typhoid fever, 77, or 20 per cent., could be traced with great probability to chronic typhoid carriers. The role played by such individuals in the spread of typhoid fever makes it of the utmost importance to find a simple and accurate method for detecting them. The examination of the feces for the presence of the typhoid bacillus, which is as yet the only method employed, is difficult to carry out, and is unreliable. The organisms may be absent from the stools over long periods, so that repeated examinations are negative, and also there is always the chance that a suspected person may send a specimen of feces not his own, lest he be proved a carrier. Gaehtgens' investigations have been on the occurrence of antibodies in the blood of persons who have had typhoid fever. Previous research has shown that during the course of the disease there is a distinct rise in the opsonic index. The determination of the index on twelve persons who had had typhoid fever, but who were not carriers, showed that, except for a slight rise (1.4; 2.1) in 2 cases whose illness was only three to four months previous, the opsonic index was normal. Sixteen cases, however, who had been proved to be typhoid carriers, showed, with one exception, a distinctly high index, which averaged 2.8. The only instance in which the index was not high was in a man who had typhoid twenty-nine years before, and from whose stools the organisms were often absent for months at a time. The occurrence of agglutinins in the serum of typhoid carriers was also determined, with the result that while opsonins and agglutinins were frequently found increased in association, the agglutination reaction was negative in 25 per cent. of the cases, and was thus of much less value in the recognition of carriers than was the opsonic index.

The Measurement of the Blood Pressure.—In an effort to determine the value of the obliteration of the pulse as an index of systolic pressure, LEONARD HILL (*Heart*, 1909, i, 73) found no evidence that the resistance (hypertonus) of the arterial wall to compression affects it. Relative softness or hardness of the arterial wall affects the conductance of the systolic wave, and modifies the reading, especially if the systolic wave is large. The arm and leg readings are the same in young men in the horizontal position, and differ in the standing or inverted posture by the hydrostatic pressure of the column of blood which separates the points of measurement. In vertical postures the leg pressure is very variable, while the arm pressure is kept about constant. The arm and leg readings differ after violent exercise and in aortic insufficiency because the big systolic waves are conducted better down the leg arteries, which are slightly thicker or more contracted and rigid. A marked difference between arm and leg readings was found in all cases of aortic regurgitation; in persons lying quietly in bed Hill considers such a difference as a sign of diagnostic importance. The two factors to be taken into account in reading systolic pressures are the actual maximal pressure of the cardiac output and the conductance of the pressure wave by the artery. The force of the wave is damped down in soft arteries, as sound waves are damped by velvet. Blood pressure readings should be taken under uniform conditions, with patients lying hori-

zontally, not emotionally excited, not after exercise, not after taking hot food, tea, coffee, or alcohol, and not after the hand and wrist have been warmed or chilled. The pressure should not be read when it is first raised, but after it has oscillated up and down several times, since this gives a more accurate index, especially in the leg arteries. The reappearance of the pulse gives the pressure more exactly than the disappearance.

The Examination of the Eye-grounds in the Differential Diagnosis between **Pernicious Anemia and Severe Secondary Anemia.**—HESSE (*Deutsch. med. Woch.*, 1909, xxxv, 1394) calls attention to the fact that in the diagnosis of pernicious anemia the examination of the retina is of great value, especially in those cases in which the blood picture is indefinite. In 47 out of 50 cases of pernicious anemia, retinal hemorrhages were found to be present; while in 51 cases of severe secondary anemia, in which the hemoglobin was below 50 per cent., and in 121 cases with a hemoglobin of 50 per cent. to 70 per cent., retinal hemorrhages were never found. In 64 instances of malignant tumor (43 of carcinoma and 29 of gastric carcinoma), in which there is especially liable to be confusion with pernicious anemia, he never saw retinal hemorrhages. Hesse believes not only that the presence of hemorrhages favors the pernicious type of anemia, and their continued absence a secondary anemia, but that they are of prognostic importance as well. In general the retinal hemorrhages are larger and more numerous in the severe cases, and the clearing up of the hemorrhages is one of the earliest indications of beginning improvement.

Nodal Bradycardia.—In the new English journal devoted to the circulation (*Heart*, 1909, i, 23) MACKENZIE describes a hitherto unnoted type of bradycardia in which venous tracings show no wave due to the contraction of the auricle, and in which he believes the stimulus of the heart's contraction arises not, as normally, in the great veins, but in the auriculoventricular node, causing a simultaneous contraction of auricles and ventricles. In the four cases reported, the bradycardia was either temporary or permanent. The heart's rate averaged 30 to 40 per minute, and the rhythm was regular or irregular, with frequent long pauses. Two of the patients had attacks of syncope and convulsions, so that they simulated closely cases of heart-block (Adams-Stokes syndrome), but the venous tracings never showed evidence of disturbed conduction, nor was there any pulsation in the veins due to auricular systole. This type of bradycardia may arise suddenly in a heart previously showing a normal rhythm, or it may arise in a heart previously showing the nodal rhythm of the usual type, with the rate more frequent than normal.

Clinical Symptoms of Hypertrophy of the Left Ventricle.—KURT (*Wien. klin. Woch.*, 1909, xxii, 1120) calls special attention to the significance of the heaving apex impulse as a sign of left ventricular hypertrophy. As evidence of moderate hypertrophy he believes the accentuation of the first sound over the left ventricle, just above the apex, to be of considerable importance. Normally, the first sound is less loud over the

left ventricle than over the conus of the right ventricle. He found this accentuation of the first sound to be present in cases of hypertrophy following exercise, pregnancy, old age, and associated with obesity, certain valvular lesions, early arteriosclerosis, and nephritis. It was not present in cases of orthostatic albuminuria. The weakening of the first sound, so frequently noticed with the heaving impulse of marked hypertrophy, he considers to be chiefly a matter of poor sound conduction.

The Rise of Blood Pressure in Nephritis.—MARCUSE (*Berlin. klin. Woch.*, 1909, xlvi, 1352) bases his theory of the rise of blood pressure in nephritis on the investigations of Wiesel and Schur as to the presence of adrenalin in the blood of patients suffering from nephritis. He suggests that the renal inflammation causes an obstruction to the flow of blood in both kidneys, and that as a result of this there is an increased flow of blood in the inferior suprarenal artery, which is a collateral of the renal artery. The consequent hyperemia of the adrenals would lead to their hypertrophy, and with this would come an increase in the production of adrenalin which would cause a rise of blood pressure.

Effect of the Injection of Bile on the Circulation.—While it has been generally considered that the slowing of the pulse and the lowering of blood pressure in obstructive jaundice is caused by the retention of bile salts, KING and STEWART (*Jour. Exper. Med.*, 1909, xi, 673) have shown, by the intravenous injection of whole bile and of its constituents into dogs, that these substances play a very unimportant part. The injection of pig's whole bile caused a preliminary rise in blood pressure, then a progressive fall, followed by a slowing of pulse rate. The bradycardia is due to heightened vagus tone, as it is relieved by cutting the vagi, or by the administration of atropine. The injection of an amount of sodium gylcocholate somewhat in excess of that contained in a lethal dose of whole bile produced no circulatory effects. The injection of bile pigment (biliverdin), however, produced all the effects of the injection of whole bile, except for the initial rise of blood pressure, and the lethal dose of uncombined pigment corresponded almost exactly to the amount of pigment contained in a lethal dose of whole bile. Experiment also showed that when the bile pigment is in chemical combination with calcium or sodium, a comparatively non-toxic compound is formed. To study the role of calcium in the action of pigment further, obstructive jaundice was produced in dogs by tying the common bile duct. An analysis of the tissues then showed a definite increase in the calcium content of the blood, and a definite diminution of calcium in muscle, liver, and brain. They believe that the bile pigments circulating in the blood in obstructive jaundice absorb the available calcium from the organs and tissues, and by combination with it render themselves less toxic.

The Influence of the Thyroid on Carbohydrate Metabolism.—KING's experiments (*Jour. Exper. Med.*, 1909, xi, 665) relate to the interaction of the thyroid and pancreas. Clinically, glycosuria is not uncommon in exophthalmic goitre, while in myxœdema it practically

never occurs. GRAY and DE SAUTELLE (*Jour. Exper. Med.*, 1909, xi, 659) have shown that glycosuria produced by the administration of ether is materially reduced by extirpation of the thyroid. In order to exclude as far as possible the action of organs other than those under investigation, and to make the conditions as simple as possible, King used Cohnheim's method of working with extracts of organs. His object was to find what influence the thyroid gland has on the action of muscle juice and pancreatic juice in breaking down dextrose. A series of experiments showed that the addition of thyroid to the mixture of muscle, pancreas, and dextrose retarded very definitely the destruction of dextrose. The same result was obtained when the thyroid was boiled—proving that the action was not due to a ferment, but to a thermostable body. Further work showed that iodothyrin, the active substance of the thyroid, acts exactly as does normal thyroid. His experiments show that the relation between the thyroid and the pancreas is antagonistic, in that the carbohydrate mechanism is rendered less efficient when the thyroid enters into the reaction, and they agree with the clinical evidence, which shows that the thyroid has a very definite control over carbohydrate metabolism.

SURGERY.

UNDER THE CHARGE OF

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Transplantation of Joints.—LEXER (*Archiv f. klin. Chir.*, 1909, xc, 263) believes that the transplantation of joints has a future, but that its perfection will come slowly. He offers some observations which he has made in connection with his experience. The incision should be in the form of a flap which should be so made that it will avoid as far as possible, falling over the transplanted part, so that there will be less opportunity for the escape of wound secretions at a suture and the formation of a fistula. In resections of the knee, the incision should begin on each side on a level with the upper border of the subcrural bursa and should extend downward to the tuberosity of the tibia, where the transverse portion of the incision is placed. The part should not be rendered bloodless for the removal of the diseased or injured joint preparatory to transplantation, since the least collection of blood would prevent the early adhesion of the soft tissues to the transplanted joint, which is necessary to quick healing. In fashioning the defect for the reception of the transplanted joint, the bone should be divided at right angles to the long axis. It may even be notched to

prevent rotation of the transplanted bones. In either case the parts should be fitted exactly together. The new joint itself should be as nearly intact as possible, and should be obtained from a simultaneously amputated limb. It should not be the seat of disease, injury, or tumor, so that the supply of proper material is scanty. Lexer believes that such joints remain sterile, as a rule, twenty-four hours after removal. He suggests that under the strictest antiseptic precautions, a joint may be taken from a dead body. The preparation of the part to be transplanted is very important. All ligaments, tendon attachments, fat, and muscles should be carefully separated from the periosteum, and the joint should be transferred immediately without contact with aseptic or antiseptic solutions. If any free periosteum remains attached to the bone ends of the defect, it should be made to cover the approximated cut ends of bone of the defect and transplanted joint. In one case a transplantation of a complete knee-joint, with its internal ligaments intact, at the end of two months, was successful, in that there was fair movement and no fistula. A month later, however, a fistula had developed. In fixing the transplanted piece in place, the use of all foreign bodies, such as nails, wire, or ivory pegs, should be avoided. If anything of the kind is necesssary, pegs of fresh bone should be employed. Plastic operations on the muscles are very important in the later function of the joint. The difficulties are considerable, however, on account of the frequent contraction and atrophy of the muscles or their destruction by disease. In the after-treatment, the first movements should be undertaken as soon as union is obtained between the bony ends. The end results can be judged only after a long time. Of most importance is the preservation of the cartilage.

Experimental Investigations on the Sensibility of the Abdominal Cavity. —RITTER (*Archiv f. klin. Chir.*, 1909, xc, 389) says that the question concerning the sensitiveness to pain of the abdominal cavity has been variously answered. He carried out a series of experiments on dogs and rabbits to determine this question. All the animals, especially the dogs, possessed a marked sensibility in all organs. To obtain positive results it was necessary to observe certain precautions. The use of local anesthetics, such as cocaine or its substitutes, as well as general anesthetics, was avoided, and, at the most, morphine was depended on. Parts poorly supplied with bloodvessels were the least painful. The bloodvessels themselves were the most painful. The best test of sensibility was by the ligature of bloodvessels. The pain caused by ligature was greater than that produced by irritation of the parietal peritoneum or pulling on the mesentery. Exposure of the intestine to the cold air or exposure to ordinary temperature for a long time causes the sensibility to diminish rapidly. The intestines are most sensitive in acute conditions. There have been observations made in men which tend to show that the abdominal cavity in them is sensitive. There are, possibly, certain differences between men and dogs. In men the ligation of vessels is especially painful. The lack of sensitiveness in the abdominal organs in men can not be due to the effect of infiltration anesthesia by cocaine, because this has a purely local effect. By the use of cocaine, however, the painful ligation of the vessels can

be prevented. The best explanation for any lack of sensation in the abdominal organs is to be found in the damage done to the fine sensory fibers in the abdominal cavity. These injuries have been demonstrated by various investigators, but only in animals. They can, however, be accepted for the same conditions in men.

An Operative Cure of a Hernia into the Fossa Duodenojejunalis of Treitz. —HELLER (*Archiv f. klin. Chir.*, 1909, xc, 360) reports a case in which a man had been suffering for six months from a chronic intestinal obstruction, and had become very weak and miserable. Vomiting occurred every twelve to twenty-four hours, with a sudden ejection of 1 to 2 liters of a gall-stained watery fluid, but without bad odor. The central parts of the abdomen were distended, the flanks rather sunken. The central distention was in the form of a globular tumor about the size of a man's head, in the region of which peristaltic movements were visible and audible. The diagnosis of a probable tuberculous peritonitis was made, with a kinking of the upper part of the intestine. After a wide opening of the abdominal cavity had been made, there was visible a tumor which had somewhat the appearance of a thick-walled ovarian cyst. The large intestine could not be seen encircling the mass of small intestines. Upon raising the lower pole of the tumor, the lowest coils of the ileum could be seen slowly emerging from a funnel-shaped opening. They were adherent to the margins of the opening, and could not be drawn out. The hernial sac was then split in its whole extent in the median line, when the enormously distended coils pushed out. They were, however, adherent within and were separated with much difficulty. From the duodenojejunal flexure to the cecum the coils were separated from one another, centimeter by centimeter, in order to remove the numerous kinks in them. The stomach was seen to be very much distended, and to be continued with a wide open pylorus over into the duodenum, which was almost as large as the arm. The stomach and pylorus, as well as the enormously distended ileum, were especially adherent to the inner wall of the sac, and kinked. The remaining intestines were also dilated and hypertrophied. At the completion of the separation of the intestines, the patient was in collapse. Two days after operation he again became acutely collapsed. Upon a partial reopening of the abdominal wound, an acute dilatation of the stomach was detected. A Kader fistula was made into the enormously dilated ileum, from which escaped large quantities of gas, but almost no fluid. The patient improved. On the fourth day the fistula had closed. A half year after operation the patient had gained eighteen pounds. Digestion continues without disturbance.

Reduction of an Unreduced Dislocation of the Shoulder by Posterior Arthrotomy.—MADELUNG (*Archiv f. klin. Chir.*, 1909, xc, 1126) in resections of the head of the humerus, employs the Kocher method, which consists of a curved posterior incision with a chiselling off of the spine of the scapula. It gives a free exposure of the joint, the function of the deltoid and the other shoulder muscles remains good, and subluxation of the upper end of the humerus toward the coracoid process is prevented. Madelung employed it in a case of subcoracoid dislocation of the

right shoulder, unreduced seven weeks after the accident. The right arm and hand were apparently paralyzed, although there were no considerable disturbances of sensation. The elbow was rigid in a right-angle position. An attempt to reduce the dislocation under ether was unsuccessful. By the Kocher method the shoulder-joint was exposed and opened. The dislocation was easily and quickly reduced by the use of a strong resection hook, which was aided by a large lever with a spoon-shaped end. The acromion was fastened in position with sutures. Three days after operation passive movements and the use of electricity were begun. The wound was completely healed in seven days, but the symptoms of paralysis disappeared slowly. Ten weeks after operation the patient could elevate his arm to a level with the shoulder. Passive movements in the shoulder were completely free, and he could make a fist. Pronation and supination at the elbow were possible. Active extension, however, was only slight.

Ligation of the Veins in Portal Thrombosis from Appendicitis.—WILMS (*Zentralbl. f. Chir.*, 1909, xxxvi, 1041), in a severe case of appendicitis, ligated the veins passing from the cecum and appendix, with the result that the chills promptly ceased, and good healing followed. The course of the case was as follows: On May 14, a man, forty-two years old, was relieved of a large appendiceal abscess, which had been developing for ten days. He had had two chills at intervals of several days. On the second day after the incision had been made into the abscess, another chill occurred; on the third day three chills with temperatures of 41.1°, 40.8°, 40.3° C., and on the fourth day a chill with a temperature of 40.4°. Two hours later the ligation of the veins was performed, and was soon followed by a normal temperature and healing without further complications. All the cases of suppurative, portal thrombosis which Wilms had previously seen proved fatal, the great danger being development of liver metastases. Early operation for appendicitis has rendered them much less common than formerly. The resection of the cecum and lower end of the ileum may come into question after ligation of the veins. In performing this operation, Wilms passed his finger under the ascending colon, which, with its mesentery and that of the lowest portion of the small intestine, were separated from the posterior abdominal wall. After division of the anterior layer of peritoneum, the vessels came well into view. The small arteries were isolated so that they would not be included in the ligatures. All the veins were then ligated in two bundles. A tampon was placed on the cecum for drainage in case gangrene of the cecum occurred. Not a single chill followed the operation. The operation must be done before liver metastases develop.

The Operative Treatment of Tuberculosis of the Vas Deferens and of the Seminal Vesicles.—CHOLTZOFF (*Ann. de mal. des org. gén.-urin.*, 1909, ii, 1121) says that these organs may be reached by one of three routes—the inguinopelvic, the perineal, and by temporary resection of the sacrum. Twelve cases are reported. When, after castration or epididymectomy, we are convinced that the tuberculous process in the seminal vesicles shows no signs of regression, but remains *in statu quo*

or is progressing, the diseased seminal vesicles should be removed, If the tuberculous process is frankly inflammatory from the beginning, and occurs simultaneously with the tuberculous process in the testicles or epididymis, the seminal vesicles should be removed at the same time as or soon after the castration or epididymectomy. If, in the operation of removing the seminal vesicles, the prostate is found to be tuberculous also, the diseased parts of this gland should be removed. When the tuberculosis involves the sexual and genital organs, the removal of the diseased parts of the genital apparatus is contra-indicated only when the tuberculosis of the urinary tract is too far advanced or there is involvement of both kidneys. If a simultaneous tuberculosis of the lungs or other organs is limited, and if it has not a marked effect on the general condition, operation is not contra-indicated. If the bad general condition depends upon the tuberculous lesions of the genital organs, we have a formidable reason for operating as soon as possible. The removal of the seminal vesicles can be performed by the inguino-iliac route in case of absolute necessity, when after orchidectomy or epididymectomy one establishes that the process has involved the whole vas deferens, and when before operation the lesion of the seminal vesicles had not been recognized. If in denuding the vas higher and higher, with the purpose of reaching a sound portion, one becomes convinced that it is diseased in its whole course, the seminal vesicle should be removed also. When the disease is unilateral the inguino-iliac route should be employed. The perineal route gives less space for the removal of the seminal vesicles than the sacral, but takes less time for the execution of the whole operation, and should be employed in feeble patients in whom the removal of all the diseased organs in two operations should not be done. In those patients in whom the removal of the diseased portions of the genital apparatus can be done in two stages, one may employ the temporary resection of the sacrum, by which more space and easy access to the seminal vesicles is afforded. The immediate results of spermatocystectomy are very satisfactory. The mortality in insignificant. There are some reasons for believing that the final results are satisfactory. A large number of cases followed for a longer or shorter time have not recurred.

The Late Results of Ureterocystostomies.—BOARI (*Ann. d. mal d. org. gén.-urin.*, 1909, ii, 1232) reports on the late results of 13 collected cases of ureterocystostomy, which have been preformed in the past ten years. One was performed in 1908, and another in 1909. In still another an autopsy had been performed a year after operation. In all the others the time which has intervened since the operation varies from five to ten years. The operation in all these cases was performed with the aid of an anastomosis button, which was first suggested by Boari. Although, in the 9 cases studied, the operation were performed by eight different surgeons, the immediate results were good in all. It was generally agreed that the technique was easy. Boari believes that the failures reported from other methods are due to: (1) The fact that the anastomoses are poorly made, either because of a faulty technique, or the sutures are too close, together causing a consequent stenosis of the orifice; (2) healing by first intention

does not ocur, so that fistulæ develop and later stenosis; (3) the condition of the kidney and ureter prior to operation interferes with success, an ascending infection often causing fistulæ. In the 9 cases the operation was necessitated by a ureteral fistula, consecutive to a severe labor or to a vaginal hysterectomy. In order to preserve the functional value of the kidney, the operation should be done as soon as possible after a positive diagnosis has been made, since infection of the kidney occurs easily. The good results obtained, and proved by a number of cases during a prolonged period, indicate that the anastomosis by a button deserves every confidence. Late stenosis has been observed in some cases in which the anastomosis was made with sutures, but never in those made with a button.

The Double Filigree Operation for the Radical Cure of Inguinal Hernia.— McGAVIN (*Brit. Med. Jour.*, August 14, 1909) says that it is the general complaint of surgeons that in inguinal herniæ in patients of poor physique, in elderly subjects, in those whose occupations involve a constantly recurring increase of intra-abdominal pressure, and in any patient in whom such a hernia has recurred or has exceeded the more moderate dimensions, the prospect of accomplishing a really radical cure is extremely remote and in some cases quite impossible. In all cases in which hernia occurs or recurs, the chief factors are: (*a*) the presence or formation of a peritoneal sac; (*b*) the recession or pushing aside of the muscular walls of the inguinal canal; (*c*) the stretching of the fibrous structures covering the canal. The method of making the filigree is described. As perfect asepsis is necessary here, or more so than in the implanting of abdominal filigrees, they should be placed in ether for five minutes, to remove all grease from them, and should be left in the sterilizer in the centre of the boiling area until the moment of implantation, when they are lifted directly from the sterilizer into the wound. The operation is at first conducted exactly as in an ordinary Bassini, except that the aponeurosis should be split to a point rather farther out, and the peritoneum must be more freely separated from the under surface of the conjoined tendon, as must the latter from the aponeurosis overlying it. The sac having been isolated and dealt with, the cord is held out of the way, and the first two of the sutures which are to approximate the conjoined tendon to Poupart's ligament are inserted, and their ends caught by pressure forceps. These sutures being held aside by an assistant, the pubic section of the filigree is placed upon the peritoneum, its narrow end being close to the pubic spine and its wide end at the inner margin of the internal ring. The conjoined tendon is then brought in close contact with Poupart's ligament over the filigree, by the two sutures already inserted, and as many more inserted as are deemed necessary, the bed in which the filigree lies being kept as dry as possible. In cases in which the muscular wall external to the internal ring is strong, the cord is placed in position and the iliac section of the filigree is taken from the sterilizer and is placed beneath the aponeurosis in such a way that its inner end lies over the internal abdominal ring and upon the cord for a space of three-fourths of an inch, the outer end being carried outward and laid upon the surface of the internal oblique muscle, one or two sutures holding it in place. If the above mentioned weakness

is present, the muscular wall is divided from the ring outward toward the iliac spine for about an inch, and is separated from the peritoneum by the handle of a scalpel. Upon this peritoneum the outer end of the iliac section of the filigree is laid, being lightly sutured in place, and the muscles are brought together over it. The inner end lies as already described. Finally, the aponeurosis is sutured and then the skin wound. This method was employed with excellent results in 33 cases, in none of which was there a remote prospect of a cure by Bassini's operation.

THERAPEUTICS.

UNDER THE CHARGE OF

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The Karell Milk Cure: Its Modifications and Indications.—ROEMHELD (*Monats. f. d. Phys.-diät. Heilkunde.*, 1909, i, 32) reviews the Karell milk cure and its various modifications. Karell, in 1865, published his results in over 200 cases treated by the use of skimmed milk. He gave about four to eight ounces of milk three or four times a day, and made an especial point that it should be taken very slowly Oertel thinks that the beneficial effects of such a cure are due simply to the restriction of fluids. He believes that such a starvation cure tends to a loss of good weight and consequent lowered vitality. Leyden agrees with this point of view, and adds that a weakened heart requires an especially nutritious diet. Hirschfeld has found this diet useful in the treatment of cardiac insufficiency, but thinks that an easily digestible mixed diet restricted in amount has equally good results. Lenhartz has made use of a modification of the original Karell cure in the treatment of chronic bronchitis, in the treatment of heart disease with passive congestion, and in order to hasten the loss in weight in obesity when the heart is insufficient. Lenhartz gives four doses of 200 c.c. of milk at four hour intervals. No other nourishment or fluids are allowed for a period of from five to seven days. In the succeeding two to six days other articles are gradually added to the diet, so that at the end of twelve days the patient is receiving a fairly liberal diet. Roemheld himself makes use of from 1000 to 1200 c.c. of milk on two days of each week. During the rest of the week a mixed diet containing two-fifths to three-fifths of the necessary amount of calories is ordered. He has found these milk days especially useful in the treatment of obesity associated with heart disease, nephritis, or gout. He uses them when the ordinary method of treatment fails or to maintain the loss of weight after the ordinary diet. Thus, a patient may control his weight for years by the interposition of two milk days a week with an ordinary restricted diet. Moritz uses large quantities of milk on a definite plan. He does not consider rest in bed essential, though the patient should be under observation for

unfavorable effects, such as headache, malaise, etc. Roemheld thinks that the beneficial effects of milk cures are due to the restricted amount of food, which, combined with rest, has a favorable influence upon the heart. The value of such a cure is enhanced by rest in bed. This is especially true in the case of the severer diets. The low sodium chloride content of the milk cures also causes an increased diuresis. Consequently, he believes that failure of heart compensation is the chief indication for the use of milk cures. Roemheld advises the method of Moritz and his own method for the treatment of obesity. He thinks that a combination of the two plans is very valuable. Thus, the Moritz plan may be followed to secure the reduction in weight which subsequently should be maintained by the interposition of milk days in a restricted diet. The loss of proteid weight and the loss of iron can be prevented by this combination. Roemheld concludes by saying that the Karell milk cure and its modifications are not specifics for obesity, but that, with proper supervision, they are valuable adjuncts to the ordinary methods of treatment.

Calcium Lactate in the Treatment of Epilepsy.—LITTLEJOHN (*Lancet*, 1909, 4472, 1382) has treated a number of epileptics with calcium lactate, giving it in doses of 15 grains, three times a day. He says that the improvement in these cases is sufficiently marked to justify his recording the facts. All of the patients (number not given) improved under this treatment. Littlejohn gives the detailed histories of two of the more successful results obtained, and hopes that others may be persuaded to try this treatment.

The Use of Cerium Oxalate for the Relief of Vomiting.—BAEHR and WESSLER (*Archives Int. Med.*, 1909, iii, 516) have endeavored to determine experimentally the usefulness of cerium oxalate as an antemetic. Their conclusions are as follows: (1) Commericial cerium oxalate is non-toxic. (2) Cerium oxalate has no inhibitory effect whatever on vomiting of central origin. (3) Cerium oxalate may inhibit vomiting due to local irritation of the gastric mucosa, but only if given in large doses for some time, so as to coat the stomach wall pretty generally. (4) Cerium oxalate is not absorbed from the gastro-intestinal tract. Baehr and Wessler say that these four propositions complete a very close analogy between cerium oxalate and bismuth subnitrate. Both salts are insoluble and, because of this property, neither is absorbed from the gastro-intestinal tract. This latter fact, in the case of bismush, has resulted in its use for various local disorders of the alimentary canal, but, so far as the literature furnishes any evidence, the use of cerium oxalate has been directed, in great part against the reflex vomiting of pregnancy, a condition in which no one could rationally think of using bismuth. They say that cerium oxalate ought to prove efficacious in alleviating all those conditions for which bismuth is now used. Cerium oxalate has been found valuable in relieving the irritability of the stomach in alcoholic gastritis and in allaying the gastric disturbances that occasionally occur in the course of the infectious diseases. They believe that there is no reason for doubting its value in these and similar conditions, such as gastric ulcer. However, they believe that most men

prescribe cerium oxalate in too small doses, 2 to 3 grains. Since it appears that cerium oxalate accomplishes its purpose by mechanically coating the walls of the stomach they advise the administration of cerium oxalate in doses comparable to those in which bismuth sub-nitrate is given.

The Treatment of Fibrinous and Serofibrinous Pleuritis.—LORD (*Boston Med. and Surg. Jour.*, 1909, clx, 469) says that it appears to be estab-lished that at least three-fourths of the primary pleurisies with effusion are tuberculous. It is also especially significant, he adds, that out of every ten cases of primary fibrinous or serofibrinous pleurisy, at least three or four develop pulmonary or other tuberculosis within an average period of from four to six years. Therefore, Lord suggests that it seems not too radical that all cases of primary fibrinous and serofibrinous pleurisy, even the mildest forms, in patients otherwise in apparent health, should be treated as if they were tuberculous until they can be proved otherwise. Lord discusses the question of thoracentesis in detail. He has collected a series of 500 cases of serofibrinous effusion, in which sudden death before tapping occurred in three patients. The autopsy showed the cause of death to be pulmonary embolism in two, of whom one had a double effusion, the second a large unilateral accumulation. In the third case, no other cause than pulmonary œdema could be dis-covered. The frequency with which effusions may be complicated by venous thrombosis also suggested itself to Lord by the occurrence of five cases of pulmonary infarction in a total of fourteen autopsies in this series. He thinks that the removal of fluid and the consequent change in the intrathoracic pressure may dislodge a thrombus and thus cause the infarction. He considers thrombosis with the danger of subsequent embolism and infarction more liable to occur in effusions of long dura-tion, and consequently advocates their early removal. Furthermore, these dangers are increased in double effusions and in large unilateral effusions. Lord also discusses the advisability of tapping medium-sized and small effusions. Many clinicians maintain that a pleural effusion has a conservative function, limiting the respiratory motion on the affected side and thus giving the affected lung the opportunity of spon-taneous healing. In addition, the fluid may contain protective sub-stances. Lord says that the clinical evidence supporting these views is inconclusive. However, he believes that the removal of medium-sized and small effusions is not immediately necessary. A short delay may furnish evidence of spontaneous absorption. If this does not occur he advocates tapping. The relief of the pressure alleviates the symptoms, and the course of the disease seems to be shortened. The early removal of the fluid may prevent the formation of venous thrombi and conse-quent pulmonary infarction. In addition, the danger of pleural adhe-sions is lessened by early removal. In his series of cases there was less tendency for a re-accumulation of the fluid after early tapping. Lord also mentoins the fact that the early removal of fluid excludes the pos-sibility of mistaking an empyema for a serofibrinous effusion. With reference to the amount of fiuid to be withdrawn at a single tapping, Lord advises immediate withdrawal of the needle whenever there are any symptoms of distress. These symptoms are usually cough, pain,

or dyspnœa. Usually 1500 c.c. should be the maximum amount withdrawn and more than 2000 c.c. should never be withdrawn. The operation, is usually without any danger in uncomplicated cases in young subjects. In cases of longer duration, however, or those with complicating pulmonary, cardiac, or mediastinal disease, and in patients past middle life, Lord says that the first operation may well be regarded as an experiment. The accidents that may occur are fatal pulmonary or pleural hemorrhages, pulmonary infarction, and pneumothorax. Albuminous expectoration usually results from the removal of too large quantities of fluid, though a few cases have been reported after removal of very small quantities. Lord prefers to use a trocar and cannula with only slight negative pressure exerted by the aspirator. He believes that the cannula is less irritating to the lung and pleura, and in the event of the cannula becoming blocked it may be opened by re-inserting the trocar.

The Employment of Iodopin in Syphilis.—FRESHWATER (*Brit. Med. Jour.*, 1909, i, 1228) gives the technique of the administration of iodopin. Iodopin is prepared by repeated iodization of sesame oil by means of iodine monochloride in alcoholic solution. It is a light oily liquid, and is prepared in two strengths, 10 per cent. and 25 per cent. More recently a solid iodopin has been introduced, and is supplied in yellow-coated tablets of $7\frac{1}{2}$ grains each, corresponding to one grain of potassium iodide. Iodopin may be given by the mouth, or by subcutaneous or intramuscular injection. Freshwater prefers to use the 25 per cent. iodopin, intramuscularly. He gives it in doses of 20 grains, injected daily or every other day. These are given until a total of from 200 to 300 grains of iodopin have been injected. He gives one or two such courses of treatment during a year. No more than six courses of iodopin should be given to the individual patient because of the infiltration of the buttocks resulting form the injections. Freshwater sums up the advantages of iodopin as follows: (1) It is often necessary to give a long course of iodine to patients who are unwilling to take iodide, either because of its depressing effects or because they are the subjects of iodism. (2) All the iodopin injected is used up and must exert its specific action; an exact dosage is, therefore, possible. (3) Injections are painless, and there is no fear of sepsis if proper precautions have been taken. (4) Iodopin subcutaneously does not produce iodism. Patients who have an idiosyncrasy to potassium iodide can take it quite well. (5) Patients remain much longer under the influence of iodine than when iodine is given in other forms. After a short course of injections the system can be kept for a period of four to six months under the influence of iodine. (6) The body is under a slow, continuous, regular action of iodine, which is of prophylactic value. (7) In nearly all cases, after a prolonged course of potassium iodide, there are stomach and bowel troubles. This does not occur with iodopin. (8) It has a specific action in tertiary syphilis and arterial degeneration. Freshwater adds that the disadvantages to the use of iodopin may be briefly summarized as follows: (1) In cases of syphilis, when a rapid therapeutic effect of iodine is required, iodopin is of little use, as the absorption of iodopin is extremely slow, two to ten days elapsing before the iodine can be definitely demonstrated in the urine, so that in cases in which there is a threatened perforation of the

palate, cerebral gumma, etc., potassium iodide should be given. Iodopin is not a subsitute for potassium iodide when active lesions are in progress. (2) A further disadvantage is that only a small amount of iodopin can be absorbed per diem, about one-third what would be given in the ordinary way by the mouth. This can, however, be turned to account in various ways. For example, in tertiary syphilis, after potassium iodide has been administered somewhat vigorously, a course of iodopin injections may be given, and the patient may then be left without medicine for some months, during which time the physician knows that iodine is daily passing through his tissues.

A Contribution to Digitalis Therapy,—MÜLLER (*Münch. med. Woch.*, 1909, xviii, 904) reports a series of cases treated, some with digalen and some with digitalis leaves. MÜLLER says that digalen should not be termed soluble because it apparently does not go into solution in pure water, but only in a mixture of water, alcohol, and glycerin. He has found it unsatisfactory for subcutaneous or intramuscular injection, the injections being painful and at times causing considerable inflammatory reaction. Many of the French observers, Müller says, have found that it possesses no such advantages over other preparations of digitalis as have been claimed. Other observers have advocated the use of digalen because of its lack of cumulative action and of its less irritative action upon the stomach. Müller administered the digalen by the mouth in this series. He found that digalen was as effective as other digitalis preparations, but could determine no superiority. Digalen was apparently less irritating to the stomach, but Müller could not definitely determine a lack of cumulative action. He concludes, therefore, that digalen differs but little in its action from other preparations of digitalis, and has no marked advantages over the other preparations.

The Therapeutic Action of Potassium Bitartrate.—EICHHORST (*Med. Klinik*, 1909, xi, 381) reports three severe cases of ascites due to cirrhosis of the liver treated by potassium bitartrate. The potassium bitartrate owes its beneficial action to its marked diuretic properties. This diuretic action does not occur immediately, but after the diuresis is once obtained it persists for some time. In one of the cases described this medication was kept up for four months with marked benefit. The patients lose the ascites, their appetite returns, the bowels move normally, and they gain in strength. At the same time the subicteroid tinting of the skin and conjunctivæ disappears. Eichhorst's experience has taught him that the operative treatment of patients with cirrhosis of the liver offers but little hope. He has also had disappointing results with other drugs, and, therefore, highly recommends the use of potassium bitartrate. Eichhorst first excludes tuberculous peritonitis in cases of ascites by means of tuberculin. He has the abdomen rubbed once a day with green soap, and puts the patients on a milk diet or on a light mixed diet with the addition of three pints of milk a day. He also gives potassium bitartrate in cases of pleurisy with effusion, but its effect in this is not so remarkable as in the ascites due to cirrhosis of the liver.

PEDIATRICS.

UNDER THE CHARGE OF

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The Relation of Infectious Diseases (Measles, Whooping Cough, and Influenza) to Tuberculosis in Children.—EDGAR COPELAND (*Archives of Pediatrics*, 1909, xxvi, No. 7) concludes that the development of tuberculosis as a complication or sequel to measles, etc., is all but invariably dependent upon the preëxistence of a latent focus of infection, and that its dissemination is directly due to the lymphatic activity accompanying the pulmonary inflammation associated with these diseases. In a large number of cases tuberculosis may develop a long time after the infectious disease which is its etiological factor—from a few months to several years. He emphasizes the prevalence of latent tuberculosis in children, which he has proved at autopsy findings to be 7 to 8 per cent. at one year. Some investigators, like Kelynack, claim 40 per cent. of all children under fifteen years show evidences of tuberculosis. The infectious diseases are characterized by marked catarrhal inflammation of the mucous membranes of the entire body, and by greatly lowered powers of resistance to secondary invaders. He believes the key to the connection between tuberculosis and these diseases is this catarrhal condition of the respiratory mucous membrane; not in predisposing to infection, but rather in promoting activity of a quiescent disease. The lymph streams swollen to many times their normal volume, flowing through the tuberculous foci, sweep the bacteria into the circulation for distribution over the entire body. Depending on the virulence and amount of the infectious agent, and on the resistance of the tissues, general miliary disease may or may not ensue. Many cases of bronchopneumonia on which tuberculosis is supposedly engrafted are really miliary tuberculosis from the beginning. The extreme grade of inanition following these three infectious diseases lower resistance and favor the disseminating tubercle. Influenza is rarely if ever followed by tuberculosis when such a condition did not previously exist. The incidence of tuberculosis as a complication or sequel of these three diseases is of relatively small importance, considering the morbidity of the diseases.

The Incidence of Tubercle Bacilli in New York City Milk.—A. F. HESS (*Jour. Amer. Med. Assoc.*, 1909, lii, 1011) has studied the milk of the city of New York to determine the number of instances of tubercle bacilli in it, to study the nature of these bacilli, and to report on the health of children known to consume this milk. He found virulent bacilli in 17 of 107 specimens examined, in all 16 per cent. of the milk retailed from cans in New York City. Animal inoculation had to be resorted to, to demonstrate them. Cream and sediment contained them, making it necessary to use both in making inoculations. The organisms were also found in one specimen of commercially pasteurized

milk, showing that this method, as now carried out, does not insure protection. The label "pasteurized" should only be given to milk heated for a length of time and to a degree of temperature sufficient to render it an absolutely safe food. In 16 of the specimens the type of bacillus was bovine; in the last a human variety was differentiated, showing that contamination from tuberculous individuals should be guarded against. A number of infants and young children who drank such contaminated milk, when examined one year later, seemed to be in average health. One fourth reacted to tuberculin, and one of these was in poor physical health, having suffered from a glandular infection. Even though 90 per cent. of tuberculous infections come from human beings, we are not justified in neglecting the bovine danger; a small percentage of infections means thousands of cases. Milk not coming from tuberculin-tested cows should be pasteurized or brought to a boil; all herds should be carefully examined, all cows tested with tuberculin, and all animals which react condemned or isolated.

Chronic Glomerulonephritis Treated by Double Decapsulation.—E. GARCEAU (Boston Med. and Surg. Jour., 1909, clx, 707) reports the case of a girl, aged fifteen years, who had marked symptoms of nephritis since her fourteenth year, no disease having preëxisted except scarlet fever during her first year and whooping cough during her fourth year. Double decapsulation was performed, the kidneys at that time being large, soft, regular, yellow, and mottled. The capsule was thin and easily stripped. Marked improvement followed, and nothing was complained of for more than fifteen months, when renal symptoms returned gradually, death, however, not occurring for more than three years from the time of the operation. Her life was prolonged by the operation, she suffered less, and the improvement was directly due to the operation. At the autopsy the kidneys were small, rough, nodular, and pale, thus being in marked contrast to their appearance at the time of the operation; the capsules were thickened and stripped with difficulty.

Napkin-region Eruptions in Infants.—H. G. ADAMSON (Brit. Jour. Dermat., 1909, xxi, 37) distinguishes between at least four distinct types of eruptions involving the napkin region of infants, which are of non-syphilitic nature and which must be carefully distinguished from the eruptions of congenital syphilis. The most frequently occurring of these are the various forms of erythema of Jacquet: (1) Simple erythema is found oftenest on the prominent convex surfaces of the buttocks and neighboring parts; in severe cases it may extend to other parts of the body. It is most common in very young infants. (2) The erythemato-vesicular type presents in addition toward the centre of the convex area, small bright red erosions; at the periphery of the erythematous areas are small vesicles; the erosions by coalescence denude large areas. (3) The erythematopapular type has flat red papules on an erythematous base. (4) In the ulcerating form the erosions have gone deeper instead of granulating. The last three forms occur in infants several months old. These four forms depend upon a vasomotor disturbance, possibly of gastro-intestinal toxic origin, with a determining factor of local mechanical irritation. The seborrhœic dermatitis occurs

in babies a few months old. The entire napkin region is involved. The eruption is bright red, small scales being over all. Other parts besides the napkin region are also involved, more particularly the scalp, umbilicus, behind the ear, etc. The cause of the condition is microbic and the cure a daily boric acid bath, with sulphur ointment (10 grains to the ounce). A third class of eruptions is the vacciniform ecthyma; it resembles the erosive and ulcerative stage of Jacquet's erythema, and is of streptococcic origin. The bullous impetigo is also streptococcic. It is usually found in other parts of the body besides the napkin region. The phlyctenular margins reveal the impetiginous nature of the bullæ denuded of their epidermis.

Rheumatoid Arthritis.—J. PORTER PARKINSON (*Brit. Jour. Children's Dis.*, May, 1909) reports a case in a child, aged two years and four months. There was swelling of the wrists ankles, knees, and elbows, for three months. There was a brown stain on the skin on the front of the legs and thighs and on the lower abdomen. Some of the joints were very tender. There was some effusion and considerable peri-articular swelling, but no grating, and the skiagram showed no bone changes. The spleen was enlarged, as were the lymph glands of the groin and axilla. Examination of the blood showed hemoglobin, 30 per cent; red cells, 1,000,000; white cells, 5000. The temperature fluctuated daily, the highest evening rise being 104° F. During the febrile periods the joints became worse, the spleen and lymph glands enlarged, and the child seemed to be suffering from a general poisoning. In three months the temperature fell, the joint swellings diminished, as did also the spleen and lymphatic glands, and there was no tenderness or adhesions in the joints. Salicylate of sodium seemed to give the best relief. Parkinson believes the symptoms due to periodic intoxication from one of the affected joints. The skin pigmentation is a point of resemblance to the disease as it afflicts adults.

Purpura Fulminans.—CHARLES A. ELLIOTT (*Archiv. Int. Med.*, April, 1909) reports a case in a girl, aged eight years and seven months. There was no history of hemophilia, and the child had had pertussis, measles, and varicella. Seventeen days before the onset of purpura she had a mild attack of scarlet fever, from which she recovered rapidly, with no albumin or casts in urine. The onset of purpura was marked by severe sore throat, swollen tonsils and cervical glands; systolic murmur at base of heart; temperature 102° to 104° F., and albumin and granular casts in the urine. On the third day a purpuric spot appeared on the right ankle and rapidly spread, covering the dorsum of the foot. The left ankle was next affected, until the dorsal and plantar surfaces of both feet were covered. There were large blebs on the dorsal surfaces and gangrene of the affected toes. Hematoxylin-colored areas, varying in size, appeared all over the body more or less symmetrically, and were usually œdematous and tender. Fine petechial spots were scattered over the skin of the legs and later on the abdomen and chest. There was nosebleed, excessive desire to urinate, and occasional delirium. On the fifth day an anemia developed, shown by blanching

of face, lips, and hands. Blood examination showed hemoglobin, 55 to 60 per cent.; red cells, 2,720,000; white cells, 65,400. Death occurred sixty-eight hours after appearance of purpura and twenty-two days after onset of scarlet fever. Autopsy report showed hemorrhagic subcutaneous infiltration; hemorrhagic infiltration of pelvic fascia, of submucosa of urinary bladder and of right ovary; cervical adenitis, persistent thymus, and cloudy swelling of liver and kidneys. Cultures from heart's blood, serum of bullæ, and smears from splenic pulp showed no growth. Elliott discusses 56 cases of purpura taken from literature, 9 of which were similar to his own, and followed scarlet fever during the second and third week. Fifty-two out of the 56 died, and the average course of the disease was fifty-two and a half hours after first appearance of purpura. In 32 cases no predisposing cause was given. In the remainder, scarlet fever preceeded 11, diarrhœa 3, and pneumonia, measles, and exposure each 2. The mental state usually remained clear to the end, and there was a remarkable absence of gross pathological change. It would appear that purpura fulminans differs from other forms of purpura in degree only, there being a complete chemical reaction and a progressive severity.

OBSTETRICS.

UNDER THE CHARGE OF

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Repeated Cesarean Section and its Complications.—BRINDEAU (*L'Obst.*, January, 1909) reports six cases of repeated Cesarean section. In one the placenta was attached to the uterine cicatrix of the first operation. Its separation caused considerable hemorrhage, but did not complicate the patient's recovery. In the second operation some adhesions were found between the omentum and the abdominal wall which were easily separated. The uterine incision of the first operation had perfectly healed. The incision was made parallel to the first incision. The mother recovered without complications. In the third case the omentum was found adherent and it was necessary to ligate it and separate it. The uterine wall was composed of connective tissue at the site of the first scar, and the incision was made parallel to it. The pregnancy was twins, and mother and children made good recoveries. In the fourth case the omentum was adherent to the abdominal wall and required ligation. The placenta was adherent to the border of the former uterine cicatrix. It was necessary to use caution in separating it. There was, however, no unusual hemorrhage, and the mother recovered without incident. In the fifth case the omentum was adherent and also the uterine and abdominal walls. At one point fibrous tissue had developed, which practically united the two cicatrices. Some difficulty was experienced in keeping the intestines out of the way. There was very little

hemorrhage. The next day after the operation the patient became cyanotic, and died with congestion of the lungs and anuria. The sixth patient had had a Cesarean section, and recovery was complicated by abscess in the abdominal wall. The second pregnancy was terminated by Basiotripsy. The third pregnancy was terminated by section, and there was found a considerable hernia of the abdominal wall. This was resected. The omentum was adherent, and it was necessary to resect a portion of this. The patient's recovery was complicated for several days by moderate fever. The patient presented herself some years afterward in labor with considerale fat in the abdominal wall. There was also a large umbilical hernia. On opening the abdomen the omentum was adherent, and was ligated in two portions. The intestine was wounded during the process, and the uterus was covered practically by the intestines, which were adherent to the womb. Difficulty was experienced in opening the uterus. This patient made a tedious recovery. The Fallopian tubes were ligated to prevent further conception.

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The Treatment of Sepsis with Bacterial Vaccines.—HARTWELL, STREETER, and GREEN (*Surg., Gynec., and Obstet.*, September, 1909) report 24 cases of general infections, 22 of septic abdominal wounds, 41 of local sepsis, 6 of empyema, and 4 of osteomyelitis; in all 97, treated by bacterial vaccines. In the puerperal cases very decided improvement followed with the gradual recovery of the patients. Cultures from the uterus in these cases showed streptococci or pure cultures of staphylococci. In one case an abundant growth of pseudodiphtheria bacilli were present with slight growth of streptococci. Antistreptococcic serum was used with this patient without effect. She became profoundly septic, with a large indurated mass filling the left side of the pelvis. On the eighteenth day she was inoculated with 100,000,000 pseudodiphtheria vaccine, and three days later with 200,000,000. In the next thirty-six hours the temperature steadily fell to normal, and there was a marked improvement in the general condition. She received two further inoculations with continued improvement. The temperature fell to normal on the thirty-third day and the patient was discharged on the forty-first day. There was then a dense mass filling the left side of the pelvis to the base of the bladder, with a smaller mass on the right side.

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Accidental Perforations of the Uterus and Vagina.—WETHERILL (*Surg., Gynec., and Obstet.*, September, 1909) describes the case of a patient suffering from subinvolution, in whom he used the ordinary Sims sharp curette, which perforated the uterus. The abdomen was opened and a valvular perforation, three-fourths of an inch in length, was found near the left cornu. This was closed with two fine sutures of plain catgut. Ventrosuspension was then performed, the patient making a good recovery. Wetherill adds two other cases in which the uterus was perforated by a curette, in one of which the small intestine was injured, necessitating the removal of six and one-half feet of the smaller bowel. These patients made good recoveries. Wetherill calls attention to Heineck's table, giving cases of perforation of the uterus with injury to the intestine, followed by resection of the bowel. Of these patients, 56 per cent. recovered and 44 per cent. died.

[The writer recently had occasion to operate upon a woman admitted to the Jefferson Maternity, giving a history of having tried to produce an abortion by the introduction of a glass catheter. The catheter had slipped and had gone farther than was intended, and the patient could not recover it. On admission, by vaginal examination, the catheter could be felt but could not be isolated, nor retained in any one position. An effort was made to open the posterior cul-de-sac and to grasp it, but this effort was unsuccessful. Twelve hours after admission I opened the abdomen, finding the catheter among the coils of intestine, and removed it without difficulty. There was no blood in the abdominal cavity, the uterus was slightly enlarged, evidently in very early pregnancy, and the point of entrance of the catheter could not be distinctly observed. There was, however, on the posterior wall of the uterus, where the lower uterine segment was forming, an area which, to the finger, gave evidence of marking the site of a perforation. The posterior vaginal fornix was freely incised and gauze drainage passed from above downward into the vagina. The uterus, tubes, and ovaries were inspected and brought into position, the gauze packing placed behind them, and the upper end of the gauze allowed to emerge through the lower end of the abdominal incision. Hot salt solution was poured into the abdominal cavity and the patient's shoulders raised to promote drainage. The gauze was gradually removed through the vagina, the patient making a good recovery.—E. P. D.]

Symphysiotomy.—BURNS (*Surg., Gynec., and Obstet.,* September, 1909) reports the case of a multipara who had had two living children, the third dying soon after birth. The head did not engage, and an effort was made to bring it down with the obstetric forceps, but this proved unsuccessful. She was then taken to a hospital, where the cervix was incised, the patient placed in Walcher's position, and strong traction again made with the forceps, without success. The forceps was left on and symphysiotomy then performed and the head readily delivered with the forceps. The child gasped but could not be revived. There were no lacerations of the vagina, vulva, or bladder. The cervix was repaired with catgut, and the suprapubic incision with silkworm gut. The puerperal period was without fever, the patient having pain and tenderness in the pubes, hips and outer side of the left foot for the first ten days. The head of the bed was raised to favor vaginal drainage, and the patient was urged to lie upon the sides, which seemed to produce better apposition of the edges of the joint. The patient was discharged on the fifteenth day, in good condition. [While the reporter is to be congratulated upon the success of his symphysiotomy, his case illustrates the fact that the forceps should not be applied to the head unless the head engages and moulds in the brim of the pelvis. His symphysiotomy should have been done before the forceps was tried. Obstetric surgery will not reap its just reward until this mistake is eliminated from obstetric practice.—E. P. D.]

Differential Diagnosis Between the Hemolytic Streptococci.—FROMME (*Zentralbl. f. Gyn.,* 1909, No. 35) has pursued investigations with different sorts of nutritive material, using bouillon and lecithin to recognize

easily the more virulent forms of streptococci. He finds that by the use of these substances, employing a lecithin emulsion of 2 per cent., in from twenty-four to forty-eight hours, he can distinguish the more virulent sorts of streptococci. Obviously, any method which permits the prompt and accurate recognition of the most virulent germs must be of value.

GYNECOLOGY.

UNDER THE CHARGE OF

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Complete Restoration of Genital Function in Gynatresias by Abdominal Operation.—F. COHN (*Zntralbl. f. Gynäk.*, 1908, xxxii, 1593) discusses the various methods of operation for the cure of gynatresia, and advocates the abdominal method as described by Pfannenstiel, which consists in the separation of the peritoneum between the bladder and the uterus, freeing of the posterior bladder wall down into the vaginal region; incision of the uterus and opening of the cervical canal, and suture to the opening made in the vagina. The last step may be completed by suture per vaginam. Cohn reports a case operated upon by this method in which impregnation and delivery of a healthy child occurred about seven years after the operation. He states that the ideal aim of every abdominal operation for atresia should be the restoration of communication between the vagina and the uterine cavity so as not only to insure undisturbed discharge of the menstrual blood, but in addition effect the possibility of birth by the natural passages.

Amputation of the Uterus in the Corpus to Preserve the Menstrual Function.—H. A. KELLY (*Amer. Jour. Obst.*, 1909, lix, 570) says in certain cases in which amputation of the uterus has to be done, and the conditions admit, it is desirable to preserve the menstrual function. He recommends two methods of procedure to that end: horizontal and vertical resections, and describes the technique of each. He reports nine typical cases in illustration.

Contributions to the Clinic of Gynatresia.—EMANUEL GROSS (*Ztschr. f. Geburtsh. u. Gynäk.*, 1909, lxiv, 70) reviews the literature on gynatresia, and as the result of personal observations arrives at the conclusions: (1) The Nagel-Veit theory of the evolution of deep gynatresias does not apply to all cases; the inferior end of the vagina arising from the sinus urogenitalis may be absent, although the remaining portion of the genital tube may be well developed (Case I); on the other hand, the upper portion of the vagina may be absent, while the lower third and the hymen are intact (Case II). (2) Hematosalpinges may occur in congenital deep occlusion of the single or a double genital tube. The adnexa of a

uterus unicornis, with total absence of the pars mullerica of the vagina may give rise to inflammatory symptoms. (3) The main danger in hematosalpinx lies not in rupture and primary infection in opening the atresic vagina, but in ascending secondary infection. The presence of tubal sacs is by no means to be treated lightly, as Nagel still does, but should be emptied or removed at once. That a cure with retention of menstruation may follow secondary pyosalpingitis was demonstrated by one of Gross' cases. (4) In atresia acquired during childhood there may occur later pyocolpos formation as the result of beginning sexual activity without preceding hematosalpinx. This was clearly shown in Case III, in which imperfect development of the uterus bicornis and permanent amenorrhœa existed.

The Choice of Time for Operation for Pelvic Inflammation of Tubal Origin.—In considering the choice of time for operation for pelvic inflammation of tubal origin, SIMPSON (*Surg., Gyn., and Obst.*, 1909, viii, 45) says several important and suggestive questions arise: (1) Will operation always be necessary for complete restoration of health, comfort, and functional activity? (2) If operation is decided upon, will the coincident occurrence of acute illness and operation entail more or less danger than their separate occurrence? (3) If interval operation is decided on, by what means may we determine that a safe time has been reached? The first of these Simpson answers in the negative, mentioning types of conditions that recover with non-surgical treatment. To the second question Simpson replies by stating more danger will be entailed by operating during the acuteness of the attack. Simpson answers the third question as follows: (1) The patient shall have recovered from her acute illness and shall have regained a satisfactory margin of reserve strength. (2) The temperature shall not have arisen above normal a single time for a minimum of three weeks. (3) The inflammatory exudate surrounding the focus of infection shall have been completely absorbed. (4) There shall have been no marked or persistent rise of temperature following a careful bimanual examination. These rules will permit of a mathematically exact selection of a safe time for operation.

The Involuntary Muscle Fibers of the Pelvic Floor.—STUDDIFORD (*Amer. Jour. Obst.*, 1909, lx, 23) states that on microscopic study of the tissues lying between the halves of the levator ani and posterior to the anterior end of the external sphincter in the perineal body, a large amount of involuntary muscular tissue will be found. It is in close relation to both the levator and the sphincter, some of the bands being attached to the fascia covering the upper ends of the sphincter, and running in a longitudinal direction, while other bands are connected with the fascia covering the levator on either side, and are arranged to pass transversely. It is claimed that no fibers of the levator pass between the rectum and vagina, and Studdiford believes the involuntary muscular tissue mentioned pulls the halves of the levator together in the perineum, thus assisting in the supporting function of that muscle, and particularly when special strain is put upon the perineal structures. Upon this anatomical study Studdiford has constructed a new perineorrhaphy that is used by H. C. Coe.

Indications for Operation in Chronic Inflammatory Adnexal Disease.— PROCHOWNICK (*Monatsschr. f. Gerburtsh. u. Gynäk.*, February, 1909, 174) summarizes the deductions from his experience as follows: (1) In severe cases resisting all treatment operation should be done after careful observation for five or six weeks, provided tuberculosis is not present as a complicating factor. (2) In women who show no objective signs of improvement after prolonged conservative hospital treatment, and who readily suffer recurrences, operation is to be advised. Only when prospects of abscess drainage obtain should repeated conservative measures be employed. Early intervention in such cases frequently effect conservation of organs and of function. (3) Early operation is indicated in all unilateral tumors if association with appendicitis is apparent or strongly suspected. (4) In concurrence of tuberculosis with other infections—particularly gonorrhœa—as well as tuberculosis alone, operation is indicated only in severe local disease when the lungs and urinary organs are not involved, or only slightly so. The operation should always be radical. (5) Permanent fistulous tumors, particularly suppurative adnexal tumors connected with the intestine, should be operated upon as early and as radically as possible if not accessible for extensive drainage extraperitoneally.

Wertheim's Panhysterectomy for Carcinoma of the Cervix.— BERKELEY (*Jour. Obst. and Gyn. Brit. Emp.*, 1909, xv, 145) discusses the various steps in surgical procedures which were worked out by various surgeons and culminated in the Wertheim operation for extirpation of cancer of the cervix uteri. This discussion is followed by a resume of the collected cases of this operation done in Great Britain. Berkeley regards Wertheim's operation as productive of a greater ultimate curative effect than all others for cancer of the cervix, and exhibited a clamp known as the Berkeley-Bennie clamp for clamping the vagina by the plan of Wertheim. The various phases of the operation—complications, bladder and ureteral injuries—causes of death, and mortality are each in turn carefully considered.

Dry Heat as a Therapeutic Factor in Gynecology.— GELLHORN (*Amer. Jour. Obst.*, 1909, lx, 31), after discussing the therapeusis of heat, refers especially to dry heat, which he recommends in three classes of cases: (1) Chronic exudative processes within the pelvis; (2) certain menstrual disorders; and (3) a number of postoperative conditions and complications. The principal indication for the employment of dry heat is parametric and perimetric exudates. These, when the acute symptoms have passed and absorption has been but partial, may be successfully treated by dry heat, a special apparatus for which Gellhorn recommends as a result of his experience with it. Due warning is given against relaxation in carefulness in the applications of this agent.

Suture of Recent Perineal Tears.— SIGWART (*Zentralbl. f. Gynäk.*, 1909, xxxiii, 329) states that Mayer recently reported 30 cases of perineal rupture in which the perineal surface was sutured by means of Michel's staples. Healing by first intention occurred in 27 cases; in 3 cases granulation occurred at the site of the perineal and the vaginal surface

union. Sigwart sutured 125 cases of perineal rupture with Michel's
staples; only two failed to heal entirely by first intention. The staples
are placed along the perineal surface and deep catgut sutures along the
vaginal lesion. Removal of the staples is simple and painless by employ-
ing a forceps, one jaw of which contains a hollow groove, into which the
convex jaw fits. The hollow jaw is placed under the staple, and by com-
pressing the handles the ends of the staples are separated and release the
tissues.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES.

UNDER THE CHARGE OF

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Regeneration of a Vocal Cord after Total Extirpation for Cancer.—
LANNOIS and DURAND (*Revue hebd. de laryng., d'otol., et de rhin.,*
January 9, 1909) report a case of a man, aged sixty-four years, from
whom the one vocal cord was removed in its entire ligamentous extent
and who was able to speak eight or ten days after the intervention.
They were able to watch a progressive reproduction of a new vocal
cord so well that less than two months after ablation, interesting stereo-
scopic photographs could be presented to the French Society of Oto-
rhino-laryngology. The new cord was a little smaller than that of the
other side, and a little less mobile, but it had the aspect of a true vocal
cord and fulfilled its functions in respiration and in phonation.

Intranasal Tuberculin Reaction.—LAFITE-DUPONT and MOULINIER
(*Ann. des maladies de l'oreille, du larynx, du nez, et du pharynx,* May,
1909) describe their procedure for producing a diagnostic reaction of
tuberculin on the nasal mucous membrane. An exudate ensues which
desiccates and forms a yellowish crust reposing upon a congested
mucous membrane, of which the extravasated red corpuscles cover
the crusts with little hematic points. The experimentation was made
upon one hundred patients, taken at random, and a reaction occurred
only in tuberculous subjects. The method is claimed to be as certain
as the ophthalmic reaction, and has the advantage over the former of
being innocuous.

Epithelioma of the Rhinopharynx.—DUPOND (*Revue hebd. de laryng.,
d'otol., et de rhin.,* January 2, 1909) reports a case of fungous epithelioma
in a man aged fifty-eight years, who had complained for sometime with
obstruction in the back part of his throat and impairment of hearing
in the left ear. He appeared robust and constitutionally strong, and
had never had any serious illness. The fungous growth was found
completely filling the left side of the rhinopharynx and obstructing
the left choana; the Eustachian outlet of the same side, and extending

down the pharynx to the posterior part of the tonsil. All surgical interference being contra-indicated, treatment was confined to topical applications with the tincture of thuja and of celandine, under which an enlarged parotid lymphatic gland diminished in size, while a similar carotid enlargement increased in volume. The patient was kept comfortable for a considerable time with improvements and relapses, and finally succumbed to one of the complications common to malignant rhinopharyngeal growths.

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A New Pharyngoscope.—Utilizing the refraction of the prism, HAROLD HAYS (*Laryngoscope*, July, 1909) describes a new laryngoscope modelled on the electrocystoscope. The tube carrying the lens passes through a horizontal shaft used as a tongue depressor, at the distal extremity of which are two electric lamps which illuminate the pharynx and prevent clouding of the prism. By throwing the prism in the proper directions, the pharynx, posterior nares, Eustachian outlets, epiglottis, and larynx can be more or less satisfactorily examined. Instruments passed through the nasal passages such as Eustachian catheters, for instance, can be manipulated under control of the image and seen in the pharyngoscope. The apparatus is much easier of manipulation than the laryngoscopic mirror.

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Lipoma of the Larynx.—GOLDSTEIN (*Laryngoscope*, September, 1909) reports a case of his own of which a careful study was made before and after operation, and reproduces the records of twelve cases recorded by previous writers, illustrations accompanying the records in several instances. His own case was a double lipoma occurring in a married woman, aged thirty-three years. A globular growth occupying nearly the entire lumen of the larynx was removed with the cold snare, revealing a second growth beneath. In an attempt to remove this growth with the snare it became impossible either to cut through the growth or to disengage the wire. The entire mass, snare, tumor, and larynx, was pulled forcibly upward and forward into the cavity of the pharynx, and then the pedicle of the growth was cut through with a pair of long, curved scissors. By microscopic examination the growth was verified as a typical lipoma.

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Laryngostomy.—JACKSON (*Laryngoscope*, September, 1909) describes and depicts the technique of the operation as now performed by him after a personal experience of seven patients, the last five of which are reported in the paper. Six were cured, and one still remains under treatment, the duration of treatment having varied from five months to three years.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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CLINICAL PATHOLOGIST TO THE PRESBYTERIAN HOSPITAL, PHILADELPHIA.

The Pathogenesis of Rabies.—Among the curious phenomena of rabies are the great length of incubation period (two weeks to two years) and the fact that only a small percentage of people bitten by rabid animals develop the disease (probably less than 10 per cent.), and yet when once developed, the outcome is invariably fatal. In this connection PALTAUF (*Wien. klin. Woch.*, 1909, xxii, No. 29) observed that the medullas of four people bitten by mad dogs, but dying of an intercurrent disease, produced rabies in rabbits, though no signs of rabies were apparent in the patients at any time. Two died of delirium tremens, one of pulmonary embolus, the fourth of encephalomalacia. All had been bitten within three weeks, and had received less than six injections of antirabic serum. In the case of four other people, bitten by rabid dogs, and dying of an intercurrent disease, who, however had undergone a complete Pasteur treatment, the injection of the medulla into rabbits was negative. From these observations, Paltauf deduces that the virus of rabies in the human organism is for the most part gradually weakened and destroyed without the formation of rabicidal bodies, so that in only 6 to 10 per cent. of the cases does it survive and cause symptoms. In each case, however, the patient undergoes a latent form of the disease, and their organism contains the etiological factor, whatever that may be. In the second group, however, after the immunization from the Pasteur treatment, rabicidal bodies are developed in the human organism and the infectious agent is actually obliterated.

Changes in the Hypophysis Cerebri during Pregnancy.—The morphological changes in the anterior lobe of the hypophysis during pregnancy, first observed by Comte in 1898, are discussed in great detail by ERDHEIM and STUMME (*Ziegler's Beiträge*, 1909, lxiv, 1) in 126 pages with fifteen excellent illustrations. In the normal histology of the anterior lobe, they recognize three kinds of cells: (1) The eosinophilic, which are the most numerous and usually occur in the outer circle of the alveolus; (2) the basophilic, which with the eosinophilic constitute the chromophile cells; (3) and least numerous, the chief or chromophobe cells, usually lying in the centre of the alveolus. In pregnancy, these latter cells increase enormously, so that the chromophile cells, which remain the same, are completely overshadowed. They also change in character from round nuclei, with very scanty, ill-defined protoplasm, to large, pale, oblong nuclei, surrounded by considerable, well-staining protoplasm that occasionally contains vacuoles. In this characteristic form, called "pregnancy cell," they remain until the puerperium, when

they undergo involution and either disappear or return (by vacuolization of the protoplasm) to the original chief cell. These, however, remain more numerous than at first, so that the hypophysis of a multipara can be distinguished by an experienced observer from that of a nullipara by histological examination. The whole gland, during pregnancy, increases in size (posterior lobe remaining unchanged), the main growth being toward the side, as the anteroposterior diameter is limited by the dorsum sellæ. The average weight of a nulliparous gland was found to be 61.8 cgm., of a primiparous, 84.7 cgm.; of a multiparous, 106 cgm. Clinically, some of the symptoms of pregnancy may be explained by these changes. The bloated face, thick lips, and enlarged hands (compare with akromegaly) may be due to the same cause, that is, hypersecretion of the hypophysis.

In this connection, a case reported by von Reuss is most interesting (*Wien. klin. Woch.*, 1908, No. 31). Bitemporal hemianopsia occurring during pregnancy, and disappearing during the puerperium, was thought to have been caused by the pressure of an enlarged hypophysis upon the optic chiasm.

The Influence of Cardiac Insufficiency on the Disposition of the Blood in the Organs.—H. C. THATCHER (*Deut. Archiv f. klin. Med.*, 1909, vol. xcvii) has possibly explained the rather paradoxical findings of Lowi, who showed that in states of cardiac decompensation, when the venous system was greatly engorged, the arterial pressure might even be raised. Thatcher's experiments consisted in determining the changes of volume of the various organs by means of an oncometer when sudden cardiac insufficiency was produced. This condition was produced by means of a small balloon introduced through the right jugular vein in a collapsed condition into the right auricle or inferior vena cava. By sudden dilatation of the balloon almost complete block of the returning venous blood was effected. Enormous engorgement of the liver at once followed. The liver was found capable of distending to such a degree that an amount of blood, amounting to one-third to one-fourth of its own weight, could be accommodated. The brain also showed a considerable increase in volume, but not so marked as the liver. The spleen, intestines, kidneys, and extremities, on the other hand, all showed a distinct decrease in volume. More complete investigation of the kidney indicated that with this organ the decrease in size was due to a contraction of the arteries, following the arterial anemia resulting from the venous block. This arterial contraction was so great that notwithstanding the venous engorgement of the organ its volume was diminished. The brain and liver, organs which are well known to have weak vasomotor mechanisms, followed the curve of the venous pressure; whereas, the kidney, spleen, intestines, and extremities, with their active vasomotor apparatus, adapted themselves to the sudden arterial anemia by means of powerful vasoconstriction. The nervous control of this action, Thatcher believes to be largely central, because when the nerves of one kidney were cut the organ did not contract as markedly as its fellow. Blood pressure curves were made with all the experiments, and were of great interest. With the first shock of shutting the right heart the systemic pressure fell abruptly.

But very soon it rose rather rapidly, and reached a level somewhat lower than the original. This was held as long as the right heart was blocked. Evidently, then, the organs with powerful vasomotor mechanism, by their arterial constriction, served to bring up the fallen pressure and maintain it at a life-sustaining level. In conclusion, Thatcher points out that the artificial nature of the lesion does not simulate absolutely the acute cardiac insufficiency of man, nor does it have any bearing on the chronic venous congestion of old weak hearts. But his experiments indicate what an important role the vasomotor mechanism plays in the pathology of the circulation.

Hypophysis Tumor and its Bearing on Akromegaly.—The theory of Tamburini and Benda, that akromegaly is caused by a hypersecretion of the hypophysis, as shown by an unusually large number of chromophile cells, receives important support from a case reported by ERDHEIM (*Ziegler's Beiträge*, 1909, lxiv, 233). In a case of akromegaly of ten years' duration, no enlargement of the hypophysis was found at autopsy, but instead, a tumor composed of tissue identical with the chromophile cells of the anterior lobe of the hypophysis, and occupying the body of the sphenoid bone, immediately beneath the sella turcica. The nature of the tumor is explained in the following manner: When the "anlage" of the anterior lobe of the hypophysis separates from the pharyngeal mucous membrane, it ascends through what will later be the sphenoid bone to join the posterior lobe in the sella turcica. The canal thus formed not only sometimes persists (canalis craniopharyngeus), but always contains small remnants of hypophyseal tissue. This is most thoroughly worked out by Haberfeld in the same number "Ueber Rachendach Hypophyse" (*Ziegler's Beiträge*, 1909, lxiv, 133). The tumor described has obviously sprung from one of these remnants, accommodating itself by forming a cavity in the centre of the sphenoid, and leaving the hypophysis unchanged. As it was composed almost entirely of typical chromophile cells, the occurrence of akromegaly is amply accounted for. At the pharyngeal end of the canalis craniopharyngeus, that is, the original "anlage" of the anterior lobe, Erdheim had previously found in foetuses a small mass of tissue identical with the anterior lobe of the hypophysis. Haberfeld now finds this to be constant in all ages, and adds the latin name—hypophysis pharyngea— to Erdheim's Rachendach Hypophyse. It may well be that many of the rare cases of akromegaly without hypophysis tumor could be explained by an unobserved tumor in one of these two places.

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